THE

ELECTRICAL REVIEW.

VOL. LXVIII. JUNE 16, 1911. No. 1,751.

Vol. LXVIII.] CONTENTS: June 16, 1911. [No. 1,751.

	Page
On Writing down the Capital	945
The Telephone Transfer	946
Foreign Trade in May	947
Cooling-Tower Proportions	947
Commutator Resistance and Energy Losses (*illus.*)	948
Correspondence :—	
Thermit Welds	949
Wooden Poles	949
Sag of Line Wires	949
Conducting Gelatine	949
Arc Lamp Suspensions	949
Impenetrable Tariffs	950
In Search of an Opening	950
Proceedings of Institutions :—	
The Faraday Society (*illus.*)	950
Wireless Telegraphy (*illus.*)	951
Legal	953
Business Notes	954
Notes	961
Electrical Driving of a Modern Calico Printing Works (*illus.*)	963
Electricity in a German Brewery (*illus.*)	966
The B.E.T. Report	967
City Notes	969
Electric Tramway and Railway Traffic Returns	974
Stocks and Shares	974
Share List of Electrical Companies	975
Notes on Electric Street Lighting (*illus.*) (*continued*)	977
Globes, Shades and Reflectors	979
A New System of Telephoty (*illus.*)	981
New Electrical Devices, Fittings and Plant (*illus.*)	982
Foreign and Colonial Tariffs on Electrical Goods	983
New Patents Applied For, 1911	984
Abstracts of Published Specifications	984

Contractors' Column ... Advertisement pages xxii, xxiv and xxvi

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEKKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has

BY FAR THE LARGEST CIRCULATION

of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES.—Per annum, postage inclusive, in Great Britain, 18s. 6d.; Canada, £1 1s. 8d. ($5.30). To all other countries, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE
UNIVERSAL ELECTRICAL DIRECTORY
J. A. BERLY'S).

1911 EDITION

H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

ON WRITING DOWN THE CAPITAL.

DURING the past few years we have devoted a great deal of our space to recording opinions regarding the position of British electrical industry. Everybody who had a conviction or an opinion to express as the result either of practical experience, or of a more or less close study of electrical affairs, has had the opportunity of adding his quota of information, with the consequence that the carefully observant reader now knows what everybody else thinks. Those who have chosen to do so have, for reasons which influence them, rejected this suggestion and argument and approved of that. And there so far as mere discussion goes, the matter has ended. There were many reasons why everything had not been "just so," as there are in other branches of industry besides the electrical, and until one was able to separate the wheat from the chaff, leaving the wind to drive away all that was the outcome of prejudice or pure self-seeking, there was little to seize upon, either by way of helpful argument or constructive suggestion, for common deliberation. For the present the discussion has died down, and it is far from being our idea to revive it now, yet there are points which are continually demanding attention. For instance, there is still abroad amongst us the evil price-cutter, who spoils the game for himself and others too. While price-cutting continues the shareholder may whistle for good dividends, unless share capital be reduced—contracting the capital to meet the profits, instead of increasing the profit to cover the capital. On this theme, too, much has been said, and no solution is forthcoming—from the scribes; like some other questions, it must settle itself in the actual practice of the electrical business, and we hope the day of that desirable issue is not far distant. The business men of our great electrical manufacturing firms, wearied of conducting large transactions annually purely to make the ends meet and pay their own salaries and commissions, and conscience-stricken at so repeatedly going before their shareholders with an empty hand, must continue putting their heads together and separating, until something be arrived at, it may be in the nature of a compromise, to stop so many of them doing business merely for the sake of doing it.

But we had no intention to discuss price-cutting again when we began this article, our real object was to record our satisfaction at the measure of agreement that some chairmen of manufacturing companies are now expressing with views that we dared to advance several years ago. It is as well for the better understanding of the subject when the matter is freed from political prejudices, and the present outlook not being a favourable one for those who desire political intervention for the support of the electrical industry, we can discuss an electrical industrial question without confusion being introduced. Take the statement advanced

by the chairman of the British Westinghouse Co. When directors change, as they have done with more than ordinary frequency in the case of this concern, the latest comers, who find it necessary to reorganise the capital account, are not backward in telling the truth regarding the mistaken policy of their predecessors. Mr. Annan Bryce tells his shareholders, what has been the subject of common conversation among most people in the electrical industry for a long time, that the works were put down on altogether too lavish a scale; even that costly burden of the Lot's Road turbine contract and its arbitration to the pretty tune of £120,000, if the company has ultimately to pay it, lies at the door of the present directors' predecessors. And if the British Westinghouse venture at Trafford Park which absorbed so much British capital which has been lost, has been unsuccessful so far as the company itself is concerned, has it not also been the cause of trouble to other manufacturers too, inasmuch as it brought a powerful competitor with a too-large works which must be kept going, against those who were already in the field? The British Westinghouse capital has to be written down, and when the Lot's Road arbitration matter is settled a scheme will be produced. Then, with reduced capital, there may be dividends, and the capital that remains may rise in the market estimation, to the chagrin of those who early bought in at a premium, and sold out at a loss. A question that nobody can answer with even a close approximation to certainty or accuracy, but one that many have speculated upon when they have been discussing the whole subject, is this: What would have been the position of British electrical manufacturing during the last few years if certain large American works had not been established here, or if they had been put down on a modest and reasonable scale?

Let us turn from Trafford Park to Loughborough. We find Mr. Garcke's speech at the Brush Electrical Engineering Co.'s meeting, reported in our last issue, extremely interesting. He observes a decided revival in progress in the electrical engineering industry, but the Brush Co. must reorganise its share capital in order to clear out of the way that depreciation that has not been provided for, because there were no profits out of which to pay it, and when this liability and others now in arrear, are disposed of, the profits may be large enough or the capital small enough, to permit the concern to return to the position to which it has so long been a stranger, that of a dividend-payer. We are glad to see the prominence which Mr. Garcke gives to the "constantly changing conditions" that are met with in this industry. "New inventions and applications succeeded each other with disconcerting rapidity, and made it almost impossible, speaking generally, to standardise or settle down to economic production in large quantities." He also alluded to the action of their competitors (was he alluding to Trafford Park?) "who had laid down works far in excess of the real requirements," "in anticipation of the demand for electrical production on a scale which had not yet manifested itself," and who, in their efforts to keep these works going, had accepted unremunerative prices.

Now what is going to be the result of these two capital reduction schemes? They will not reduce the size of the works, or the ability to do a still very large turnover. The companies, if they continue their present rate of profit, hope to be able to pay a dividend on a smaller capital. So we shall be in the same position, generally speaking, in respect of price-cutting unless either there is a plethora of orders, or a new policy be introduced among our large firms. That the capital of these, and no doubt some other, manufacturing companies must be written down, we do not dispute for a moment. There is no alternative, and Mr. Garcke says that *this* time it will be done adequately, which reminds one that the Brush Co. is not without experience. But in the interests of the whole industry, price-cutting should cease.

From the Brush it is not far to the B.E.T., but that is dealt with in an article appearing on another page. The capital is to be written down in that case also. Mr. Tuckett told the Urban Electric Supply Co. the other day that that concern would have been far better off without its tramways. No doubt some such sentiment possesses the B.E.T. board. Mr. Tuckett is nothing if not frank, and as he is a director of both the Urban and the B.E.T., we quote him again in this connection:—"The company was peculiarly unfortunate in embarking in the (tramway) business at a time when an exaggerated estimate was very generally entertained of the profitable possibilities of both electric lighting and tramways." The B.E.T. Co. was formed in 1896, and the Urban only two years later! We believe that—those predecessors on the board shall we say—in scrambling for tramway concessions everywhere were influenced by that same "exaggerated estimate," and secured some schemes which they would rather be without to-day. But there was profit to be made by the promotions, whether the estimate was exaggerated or not, and we find the *Financial News* of Monday last, in trying to analyse B.E.T. affairs, saying this:—"A drastic overhaul of the company's finances is long overdue, and must be thorough. The source of the trouble goes back 10 years ago, when 9 per cent. was being paid on the ordinary, and the merest trifles were being written off or placed to reserve." Those predecessors on the board again! We are not at all sure that the company man scrambling for concessions at any price has been a good thing for the electrical industry. When local authorities make their conditions too onerous, and their price too high, it may be wiser to leave them to provide their own facilities. Towns might then lose money, and the ratepayers would pay, but there would be no promoters to reap a harvest, nor would there be private shareholders to lose their capital. However, the thing is done, and cannot now be undone, and the only course is to reduce the capital and try to make the profits spread out so as to preserve a semblance to decency in the matter of reserve provision and dividend payments in the future.

The Telephone Transfer.

In his address to the shareholders of the Peel-Conner Telephone Works, reported elsewhere in this issue, Mr. Hirst championed the cause of the Post Office—a cause in support of which, apart from the staff of the department itself, we believe he stands almost alone. But in the arguments which he advances Mr. Hirst appears to miss the point at issue; it is not whether the company shall be given a monopoly, but whether the monopoly shall be entrusted to the Post Office or to a special Telephone Authority, constituted on the lines of the Metropolitan Water Board, the Port of London Authority, and similar public bodies, whose object it would be to conduct the undertaking on business lines for the benefit of the community. As regards the second reason urged by Mr. Hirst, there would be no difficulty in providing that in time of crisis the telephones, like the railways, should come under Government control; and there is no necessity for the former, any more than for the latter, to be worked by the Government at all times, in order to accomplish this. The third argument is that the telephone and telegraph services ought to be in the same hands, in order to facilitate their use as mutual aids; the Post Office, however, has for years accepted telegrams by telephone from subscribers connected to the National Telephone Co.'s exchanges, and it is difficult to see any objection to the continuance of this practice if the Telephone Authority is substituted for the company, or any obstacle to the extension of interworking suggested by Mr. Hirst.

The last reason given—that sacrifices may have to be made to various sections of the community—is one which must be regarded with the greatest reserve and circumspection. The tendencies of modern Governments are strongly in the direction of Socialism; the community is constantly being called upon to make concessions to sections of the people, to subsidise some classes at the expense of others, and generally to

"rob Peter to pay Paul." We have seen the effect of this in connection with the telegraphs, and Mr. Hirst himself goes on to say that the fact that the Post Office itself could not make the telegraphs pay was for obvious reasons, and "*not necessarily the fault of the Post Office*" (our italics). That is precisely the point—the Post Office is a semi-political concern, under constant political pressure both from its huge staff of voters and from external politicians of every hue. No doubt it is not the fault of the Post Office, which has not a free hand; but surely Mr. Hirst, as a business man of the first rank, will not seriously advocate the handing-over of the telephone service to the same influences which have rendered it impossible for the telegraphs to pay their way?

The suggestion that a private company cannot provide an efficient telephone service much more cheaply than a Government department is contrary to the general belief, but is here beside the question, as it is not proposed to entrust the work to a company, but to a public body of business men, free from political pressure.

The allegation that the Post Office has not a proper staff of engineers never came from us, nor have we met with it elsewhere; the ability of the engineering staff of the Post Office is one of the most admirable features of that department. As for the trunk service, it is admitted that it is inferior to that of the United States; true, it is cheaper also, but efficiency is the most important desideratum. The main reason for delays on trunk calls is well known to be the lack of a sufficient number of trunk lines, for the trunk wires in this country are used to a very much greater extent (probably four times) than are those in the United States. We are surprised to hear that Mr. Hirst regards the trunk service as the best part of the telephone service in this country.

The suggestion that telephone mains should be laid by the Post Office and subscribers' stations provided by outside firms, as in the case of electricity supply, is startling, but is not likely to commend itself either to the Post Office or to any other telephone authority.

It is clear from the whole tenour of the speech that Mr. Hirst anticipates for his company a flow of valuable orders if the Post Office takes charge of the telephones, and as the quality of its products has been amply demonstrated, we have no doubt that in this he is justified; but the company's opportunities would be no less favourable if the service were in the hands of a Telephone Authority, and we, therefore, feel that he need have no apprehensions on this score.

Foreign Trade in May.

THE trade returns for last month, with two working days less than the month of May, 1910, show that the exports were better by £4,007,517, or 11·9 per cent., and the increase in re-exports was £540,689, or 6·5 per cent. The imports fell by £1,299,929, or 2·3 per cent., the decrease being more than accounted for by food, raw materials, and unmanufactured goods. The electrical goods and apparatus imported, at £121,356, were £10,458 down, but machinery at £608,973 was £178,203 up. In the exports electrical goods and apparatus stand at £215,466 for the month, an advance of £8,917; machinery rose by £354,609 to £2,864,450.

COOLING-TOWER PROPORTIONS.

[CONTRIBUTED.]

THE necessity for fan draught to a cooling tower of moderate proportions arises from the fact that the tower works against itself—the up draught in a chimney tower is best when the water runs hottest from the condenser, that is to say, when the vacuum is poor.

Mr. Bibbins, of New York, who investigated the action of cooling towers under American conditions, found that with lath mats for the water to flow down, so arranged that the water had no free fall, the normal rate of heat dispersion was 200 B.TH.U. per sq. ft. of mat surface per hour. He found that where the water had any free fall, this reduced the up draught, and lowered the efficiency. The water when flowing over mats is caused to descend slowly and to give up all the heat that the air can absorb. Needless to say, the efficiency of a tower depends very largely on the dryness coefficient of the air. Each pound of water absorbed by the air carries with it in latent heat and added temperature about 1,000 B.TH.U. If the air enters the tower in a saturated condition (as to which more anon), each pound of air will only carry off about a fourth of a B.TH.U. for each degree of temperature rise. Each pound of water in the air will carry off about half a B.TH.U. for each degree of temperature rise, the specific heats of air and of water vapour being respectively 0·23 and 0·48. Thus, very much depends on the humidity of the air. A cold, frosty atmosphere is very dry, and if warmed has a great capacity for water vapour, and the escaping moist air can be fairly hot. In this country frost often accompanies a moisture-saturated atmosphere, and the only work done must then be by temperature difference. In hot weather air also carries frequently a high percentage of moisture, but a few degrees of additional temperature will render it very absorbent of moisture, and though air may be saturated with water vapour when it enters a tower, its temperature rise enables it to absorb still more moisture. It is thus not correct to assume that towers will not act in foggy weather, for since fog is usually accompanied by a fairly low temperature, the atmosphere will be foggy when it is really carrying very little moisture.

In order to economise in tower dimensions, Mr. Bibbins recommends the use of auxiliary fans to increase the flow of air when conditions are not favourable to the efficiency of a draught tower.

When a cooling plant is in a fairly exposed situation, use may be made of the natural horizontal movement of the atmosphere, and the cooler may then consist of an open stack of suitably-arranged boards through which the breezes can blow freely. Where the site is of ample area such an apparatus can be used. A fan auxiliary is not found to be necessary for more than 1 to 5 per cent. of the total hours worked.

A designer must aim to subdivide the rising air between all the spaces and to spread the descending water over all the area. The latter object is perhaps best secured by sloping slightly in alternate directions the water surfaces, so as to check free falling through any great distance. Tables giving the moisture capacity of air at various temperatures should be employed to help in the computation of the tower efficiency under extreme as well as mean atmospheric conditions. The perusal of such a table will greatly assist the designer.

Air will leave a tower saturated to its full capacity, but it is better to assume that this condition may not always be fulfilled and to calculate on a saturation of 90 per cent. This will leave a margin of safety.

Approximately each pound of steam used by an engine must give up 1,000 heat units in the condenser, and this is the heat to be given up to the air in the cooling tower. Thus, with the air specific heat of 0·25 nearly, 1 lb. of steam, assuming the water enters the tower at 100° and leaves at 60° F., will heat up 100 lb. of air by 40°. But at 60°, 100 lb. of air may be holding 0·5 lb. of water vapour. At 100° it may pass off with 4·5 lb., a take-up of 4 lb., carrying 4,000 heat units latent and thermometric. Thus each 100 lb. of air under these conditions would deal with 4 lb. of steam in respect of its moisture-absorptive capacity and with 1 lb. by reason of its own specific heat, or 5 lb. in all, so that 20 lb. of air will deal with each pound of steam. Under ordinary conditions the weight of air to be passed through a tower must be equal to the weight of circulating water. But it is better to calculate from the basis of the steam used or the feed water, or to assume that half the calorific power of the coal burned will appear in the moist air escaping from the cooling tower.

Some idea of the power needed to cool water may be gathered by assuming 12 lb. of steam per H.P.-hour. This means at least 300 lb. of cooling water raised, say, 20 ft., or, say, 100 ft.-lb. per minute. At 50 per cent. pump efficiency this represents the 165th part of 1 H.P. or about 0·66 per cent. of the main power. To lift the same weight of air by a fan less efficient than a pump might absorb 1 per cent. of the main power. Possibly the further lift of the air may be effected by the natural draught of the tower.

D

COMMUTATOR RESISTANCE AND ENERGY LOSSES.

BY W. H. F. MURDOCH, B.Sc., M.I.E.E.

ALTHOUGH a great deal of experimental work has been done on this subject,* the conclusions arrived at experimentally still remain without explanation. The following theory of the action, and comparison with the results of experiment, may be of assistance in clearing up the matter.

In the case of a dynamo commutator it seems clear that the resistance consists of two portions—viz., a constant portion consisting of the brushes and metal, and a "contact" resistance. Now, the contact resistance is obviously a surface action, and must be altered by the degree of contact, pressure, and type of brushes. The contact occurs between points of copper or points of copper and carbon, and one may imagine they pass one over the other as two fine files would if placed one upon the other and moved relatively. All experiment goes to show that the temperature coefficient of the contact resistance is negative. For small currents, or current densities, great resistance is apparently encountered. This is illustrated in fig. 1 (see Hobart and Parshall, "Electric Generators," page 271).

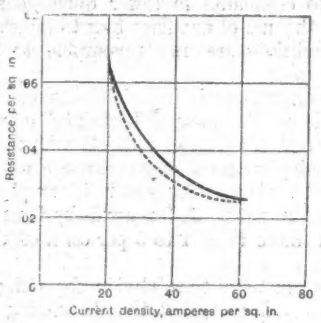


FIG. 1.

If we assume, then, that at the contacts heat is generated, and that a certain amount of it proportional to the temperature rise escapes, we shall have the following set of equations :—

$$d\theta/dt = k_1 rc^2 - k_2\theta \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

$$e = c(R + r) \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

$$r = r_0(1 - a\theta) \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

$$\text{and} \quad dr/dt = -r_0 a\, d\theta/dt \quad \ldots \quad \ldots \quad \ldots \quad (4)$$

In these expressions c represents current, R the constant resistance of brushes and commutator, k_1 and k_2 are constants, θ is temperature rise, r the contact resistance, and a the temperature coefficient. Substituting in equation (1) and eliminating r, first putting $dr/dt = 0$, we have—

$$e = \left(\frac{k_2 r_0}{k_2 + k_1 a\, r_0 c^2} + R\right) c.$$

This gives the relation between current and volt drop, or, with alteration of the constants, current density and volt drop.

Fig. 2, taken from Prof. Baily's paper referred to, is shown below ; its equation is—

$$e = \left(\frac{1}{32 + 0{\cdot}02\, c^2} + 0{\cdot}013\right) c.$$

This curve is shown dotted in the figure, the original curve being in full line except near the origin, where no points are given in the paper.

The resistance, therefore, in such cases is given by—

$$\frac{k_2 r_0}{k_2 + k_1 a\, r_0 c^2} + R.$$

This equation, adjusted to fit the part shown in fig. 1, is—

$$\text{Resistance} = \frac{1}{0{\cdot}057\, c^2} + 0{\cdot}02.$$

If c is very small, the resistance approaches the value $r_0 + R$, and a constant omitted in the denominator above is required ; if c is large, it becomes asymptotic to R.

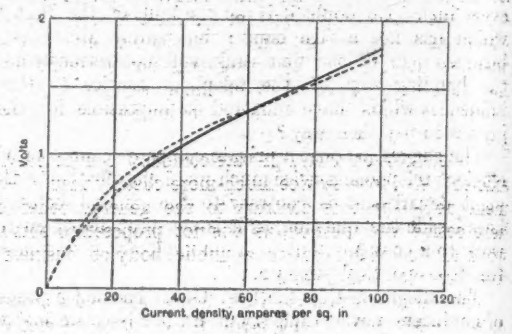


FIG. 2.

Multiplying e by c, we obtain the watts, and we might write—

$$e\,c = \frac{1}{a + b/c^2} + c^2 R,$$

where a and b are constants. By dividing by c we obtain the commoner curve—viz., watts per ampere. This, taken from Prof. Baily's paper, is shown in fig. 3.

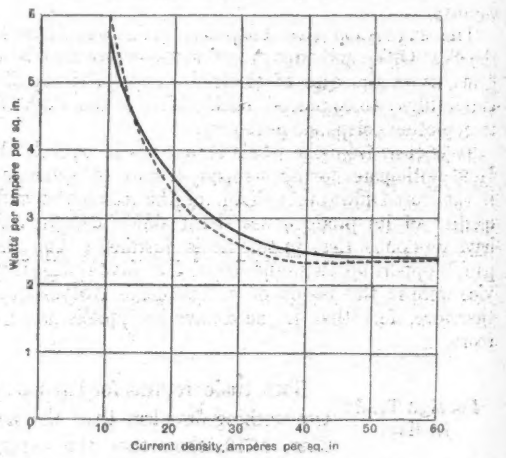


FIG. 3.

The equation to this curve is for the practical region—

$$W = 1/a\,c + c\,R.$$

This is a hyperbola with asymptotes $W = 0$, and $W = c\,R$.

Differentiating and equating to zero, we find that the watts wasted will be a minimum, when—

$$c = \sqrt{\frac{1}{a \cdot R}}.$$

The equation to the curve above shown dotted is—

$$W = 60/c + 0{\cdot}02\, c.$$

Considerations such as the above imply that all these curves are due simply to heating at point contacts, the coefficient of resistance being negative.

The writer is indebted to W. H. Eccles, D.Sc., who in his paper "On Coherers" (*Proceedings* of Physical Society of London, Vol. XXII, Part 3, September, 1910) deduced the equation given above. He found that this equation accounted perfectly satisfactorily for the action of the coherers he experimented upon, and the writer wishes to suggest that commutator losses are due to exactly the same set of causes.

* "On Coherers." Eccles. *Proceedings* of the Physical Society of London, Vol. XXII, Part 3, 1910.
"Some Phenomena of Commutation." Baily and Cleghorne, I.E.E. November 13th, 1906.
Elektrotechnische Zeitschrift. Arnold. January 5th, 1899.
For other results see Parshall and Hobart's "Electric Generators."

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Thermit Welds.

In your issue dated June 2nd, 1911, we notice, in the report of a paper entitled "Some Studies of Welds," read before the Iron and Steel Institute on May 11th, a reference to Thermit welds, in which occurs the following passage :—

"Generally the Thermit process, yielding, as it frequently does, a spongy mass of metal with blow-holes, is useful mainly as an emergency process."

As proprietors of the Alumino-Thermic patents in this country, we wish most emphatically to contradict this statement, which we think has been made without a due knowledge of the facts.

Although this statement may have had some foundation in the early days of Thermit welding, the blow-hole trouble has long since been overcome, a fact which we shall be pleased to demonstrate to any of your readers who may be interested, if they will call upon or communicate with us.

The authors of the paper are evidently unaware of the results of the tests which have been made within the last year or two, or of the fact that the process has been sanctioned by the British Corporation for the Survey and Registry of Shipping, for repairs to stern posts, rudder frames, &c., as well as by Government departments for welding special work.

We have lately received particulars of the repair to a locomotive side rod which was "Thermit" welded in 1907, and the weld remains as good as ever, although the locomotive has been running an average of 100 miles per day, five or six days per week, ever since—rather good for an emergency process.

Last year approximately 95 miles of tramway track (single) were welded in this country alone.

We think we have said enough to disprove the statement in the paper, but must say we think it a pity that the authors should not have taken some steps to verify statements of this description before publishing them.

Thermit, Ltd.
R. STUTZ, *Managing Director.*

London, E.C., *June 7th*, 1911.

Wooden Poles.

We observe that in your issue of 2nd inst., Mr. R. E. Neale, in an article dealing with channel-iron supports for electric transmission lines, states :—

1. The maintenance of wooden poles is costly.
2. Their strength decreases rapidly with time, and underground rotting often results in unexpected disaster.
3. The poles often break in the fourth or fifth year of their service.
4. The maximum permissible span is about 40 metres.

As suppliers of wooden poles for the last 50 years, we should like to point out that poles creosoted to Government conditions will be found to be perfectly sound at the end of, say, 30 years.

One of the chief advantages of creosoted poles is that the cost of maintenance is nil; they never require painting, &c., whereas the cost of maintaining tubular steel, lattice, or any similar class of pole, is considerable, and at the ground line they are found to deteriorate very rapidly.

We supply large quantities of creosoted wood poles for overhead transmission work, and many of them are erected on spans of 80 yards or 74 metres.

Armstrong, Addison & Co.

Sunderland, *June 6th*, 1911.

Sag of Line Wires.

Evidently "Colliery Electrician" requires something less simple than throwing a tape over the wire at its mid span and at each end, taking care there are no brass or other wires in the tape.

He may set up a theodolite opposite the mid span and read the angle when pointed to the wire at each support and the point of greatest sag. Then he can measure the bases of three observed triangles; he has the angles, and the vertical heights to the points sighted are the tangents of the angle of which the bases are unity.

With a ladder he may clip a bar to each of two poles and level the bars, placing them below the points of support equally a distance greater than a sag. A vertical slide on each levelled bar is then pushed up until it stands in line with the dip of the wire and the fellow vertical slide. The query is vague, but presumably the querist does not want to climb poles. So let him try the theodolite.

B.

Mr. A. P. Trotter has very kindly called my attention to the fact that my note (published in your issue of June 7th) in answer to your correspondent's inquiry *re* the above is incorrect. If the conductor be untied from the insulator on the pole between two adjacent spans of equal length the sag of the double span will be *double* (not four times) that of the single span. This can readily be proved from the formula—

$L = l + \frac{8\,d^2}{3\,l}$, where l is the span in feet; d, the sag in feet; and L, the actual length of the wire in feet.

The rule I had in mind when I wrote the previous note was that *for a given stress in the wire* the sag increases as the square of the span.

I regret very much that this mistake should have occurred, but, as Mr. Trotter has pointed out, your correspondent may measure the normal sag accurately by halving the distance between the insulator and the wire at the middle pole.

J. B. Sparks.

London, N.W., *June 9th*, 1911.

Conducting Gelatine.

I should be glad if some reader could enlighten me on the following :—

Gelatine is a bad conductor. What could one add to this substance to make it readily conduct a weak current of about 1 volt?

Water and metallic powders are a disadvantage.

I understand the presence of certain chemicals makes this substance (gelatine) conduct well.

I wish the current to pass freely and act upon certain matters suspended in the gelatine. I use bichromate batteries and platinum electrodes.

Wire Wound.

Arc Lamp Suspensions.

Although Mr. C. Gilbert, of the Gilbert Arc Lamp Co., seems to doubt the veracity of some of my remarks, perhaps he will permit me to assure him that the statements in question are quite correct and not in the least exaggerated. I have before me as I write examples of discarded suspension devices (of quite modern type, too) as criticised in my article, and which Mr. Gilbert claims in the course of his extensive experience to have found non-existent.

Mr. Gilbert's mild criticism of the use of the strain insulator on grounds of added bulk and unnecessary expense, I take to be really tacit admittance of its sterling worth for the special purpose mentioned. The first-named objection hardly holds good, as the fact that no special bracket attachment is necessary must be taken into account. As a matter of fact, the writer has found that the adoption of the strain insulator invariably results in a reduction over all of the length of suspension gear. Regarding the latter point, the extra cost is trifling, comparatively, and when one considers how mechanically weak (and this detail must be viewed in a mechanical light first) the earthenware bobbin, or shall I say, porcelain insulator is, then the question of expense is really one for secondary consideration. Further,

the smaller volume of space taken up by the strain insulator leaves the crown top of the lamp roomier, consequently there is less liability of fouling of cable leads, terminals, &c. And where necessary the fitting of weather hoods is facilitated—an undoubted advantage.

Electrically, as an insulator, that of the strain type advocated is *par excellence* the best, its obvious merits being sufficiently well known to render further recapitulation here superfluous.

That there are some other good suspension devices is unquestioned, and most makers, not unnaturally, would feel that their own particular lamps fell within that category. It is nice to hear that the "Gilbert" lamp suspension device is like unto Cæsar's wife, and the fact will, no doubt, be appreciated by those interested, at least by—

S. Lees.

Manchester, *June 11th*, 1911.

Impenetrable Tariffs.

I have before me the copy of a speech made a few days ago by the chairman of a large electrical engineering company on the occasion of their annual meeting of shareholders. Amongst other things, it contains the following statement: "It must also be remembered that, in this market of free imports, we have to meet the competition of most powerful Continental manufacturers, who, with their home markets secured to them by *impenetrable tariffs*, are able to work at a good profit, &c." By "powerful Continental manufacturers," I suppose the speaker means principally German manufacturers. If so, I cannot understand how such a statement can have passed unnoticed and without protest from those present at the meeting, some of whom must surely know that the German tariff is anything but impenetrable, at least, as far as it applies to electrical material. The import duties levied in Germany on electrical goods of English origin work out at about 2 per cent. to 4½ per cent. of the value for motors, ¾ per cent. to 1½ per cent. of the value for glow lamps, 3 per cent. to 4 per cent. of the value for turbo-generators, whilst lead-covered cable and a few other classes of goods pay no import duty at all.

I should feel obliged if you could find room for this letter in your next issue.

A.E.G. Electric Co., Ltd.
C. PFEFFER, *General Manager.*

London, W., *June 10th*, 1911.

In Search of an Opening.

Will you kindly give me some advice and information as to the best way of getting into an electrical engineering firm? I have a thorough knowledge of all kinds of iron-work, having served my time as smith; I have also done fitting work.

Do you think these qualifications will help me in any way in getting into some electric firm? Will it be necessary to pay a premium? because I shan't be able to pay a big one. Could you give me a list of firms who would take pupils on these conditions?

Ymgeisydd.

[We print this letter as a sample of many that we receive of a similar nature. The problem is notoriously a difficult one; it lies within that region which, in this country, is barren and uncultivated—the gap between early training and mature experience. Some systematic means of assisting the novice to cross this trackless waste is sorely needed. No better stuff can be found than these young men, full of energy and ambition, and eager to play their part in the battle of life; yet how difficult it is for them to find an opening in the ranks!—EDS. E.R.]

University College, London.—In connection with the organisation of the new department of heating and ventilating engineering at University College, towards which the London County Council has made a grant in aid, Mr. Arthur Henry Barker, B.A., B.Sc., Vice-President of the Institution of Heating and Ventilating Engineers, has been appointed lecturer for the session 1911-12. Mr. E. Kilburn Scott has been appointed lecturer in electrical design for the session 1911-12, in succession to Mr. H. M. Hobart, resigned.

PROCEEDINGS OF INSTITUTIONS.

The Faraday Society.

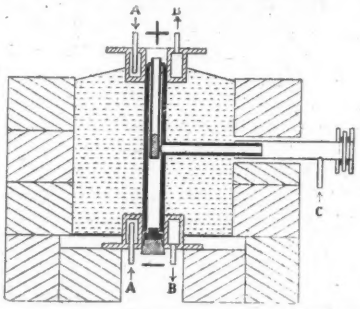
SYMPOSIUM ON HIGH-TEMPERATURE WORK.

THE symposium, or general discussion, on some branch of pure or applied physical chemistry which has now become an annual feature of the programme of the Faraday Society, took place this year on Tuesday, May 23rd, and was devoted to the subject of "High Temperatures." Dr. R. T. Glazebrook, C.B., F.R.S., the Director of the National Physical Laboratory, who is one of the Vice-Presidents of the Society, presided on this occasion, and the chief contribution to the evening's programme was made by Dr. Arthur L. Day, Director of the Geophysical Laboratory of the Carnegie Institution, Washington, whose work on high-temperature measurement is well-known for its importance and accuracy.

During the afternoon, previously to the meeting, a party of members of the Society visited the National Physical Laboratory and inspected the high-temperature equipment, afterwards described in Dr. J. A. Harker's paper. Mr. H. C. Greenwood gave a demonstration of his method for determining the boiling points of metals, and Mr. A. Blackie showed specimens and photographs illustrating the behaviour of silica at high temperatures, likewise the subject of a paper in the evening.

Dr. Day's paper, entitled "Recent Advances in High-Temperature Gas Thermometry," reviewed the present position of the gas thermometer as a standard for temperatures over 1,000° C., and indicated the lines future research was likely to take in extending the range and accuracy of this instrument, without the use of which no accurate high-temperature measurements are possible, the gas thermometer scale being the basis to which all pyrometer readings, whether of the thermo-electric or the radiator type, have ultimately to be referred.

A gas thermometer consists essentially of a bulb, or containing vessel, a gas to be heated—usually at constant volume—and a manometer to record the pressure of the gas, a knowledge of which, of course, enables its temperature to be calculated on thermodynamic principles. Subsidiary to these are the heating furnace, containing the bulb, and the secondary standard of temperature it is desired to calibrate. The gas always used now is nitrogen, since hydrogen, although approximating more closely to a perfect gas, permeates almost all substances above about 300° C. Nitrogen



ELECTRIC FURNACE FOR DETERMINING THE BOILING POINTS OF METAL. (See p. 951).

has been used up to about 1,600° without any appearance of irregularity in its behaviour, but at the temperature of the electric furnace nitrogen is no longer an inert gas, and a substitute will eventually have to be found for it. Dr. Harker thinks it will be argon, but the containing vessel has still to be invented. Dr. Day hinted at tungsten as a possible material. The containing vessel at present employed by Dr. Day is made of platinum stiffened with 20 per cent. of rhodium, as no other known material* is possible above about 1,000°, whereas this alloy can safely be used up to 1,600° C. At the lower temperatures pure silica has recently been employed with success, but above 1,100° it suffers permanent volume changes. The use of porcelain, once so common, has now definitely been abandoned. The manometer now favoured is an open U-tube connected by a capillary to the bulb of the thermometer. The volume of the capillary is so small that uncertainties arising from a want of exact knowledge of its temperature do not impair the accuracy of the readings. The furnace for heating the thermometer is now always heated electrically, for electric heating is easily controllable and easily measurable, and, therefore, any uniform temperature can be maintained without difficulty. Dr. Day ingeniously encloses both the bulb and the heating coils in an air-tight bomb, so that the gas pressure outside the bulb may be kept equal to that of the heated gas, thus preventing diffusion and minimising mechanical strain on the fragile platinum bulb. One of the great difficulties in the use of the gas thermometer is to maintain a constant temperature regularly distributed over the bulb. At the Geophysical Laboratory differences have been reduced to only 2° C.; to reduce these still further will probably require the use of some liquid bath, but what this is to consist of has yet to be discovered. For temperatures up to 650° C. a fused mixture of potassium and sodium nitrates is used as a bath for keeping constant temperatures at the National Physical Laboratory.

* The use of iridium must be avoided, as this metal contaminates platinum thermo-elements and renders them unreliable.

The auxiliary thermo-element is a most important feature of the standard gas thermometer, because whereas few can use the complicated gas thermometer, the thermo-element is of universal application, and is becoming one of the most valuable instruments of precision in the hands of chemists, physicists and engineers. The procedure, of course, adopted is to establish an empirical curve for the thermo-element by direct comparison with the gas thermometer. As this happens to be a parabola, three or four comparisons are sufficient, and interpolation may safely be applied for all intermediate points. Thanks to the work of Dr. Day and his colleagues, temperatures can now be accurately measured up to 1,550° C., and by means of the melting or freezing points of a few standard substances readily obtained in a pure state, anybody who uses a thermo-electric pyrometer can check his calibration curve from time to time by reference to one or more of these temperatures, which we have thought it worth while to reproduce here.

Substance.	Point.	Atmosphere.	Crucible.	Temperature.
Zinc	Melting and freezing	Air	Graphite	418·2° ± 0·3
Antimony	"	Carbon monoxide	"	629·2 ± 0·5
Silver	"	"	"	960·0 ± 0·7
Gold	"	"	"	1,062·4 ± 0·8
Copper	"	"	"	1,082·6 ± 0·8
Diopside (pure)	Melting	Air	Platinum	1,391·2 ± 1·5
Nickel	Melting and freezing	Hydrogen and nitrogen	Magnesia and magnesium aluminate	1,452·3 ± 2·0
Cobalt	"	"	Magnesia	1,489·8 ± 2·0
Palladium	"	Air	Pure magnesia	1,549·2 ± 2·0
Anorthite (pure)	Melting	"	Platinum	1,549·5 ± 2·0

In addition the following temperatures were incidentally obtained :

Cadmium	Melting and freezing	Air	Graphite	320·0 ± 0·3
Aluminium	Freezing	Carbon monoxide	"	658·0 ± 0·6
Platinum	Melting	Air		1,755* / 1,752† ± 5

* Extrapolation optical. † Extrapolation thermo-electric.

Prof. Max Bodenstein's communication on "Methods of Maintaining Constant High Temperatures" was in many respects supplementary to Dr. Day's paper. The lower grades of high temperatures are kept constant either by means of a vapour in equilibrium with its liquid, or by means of a liquid heating bath used in conjunction with a gas regulator operated by the heating bath.

Dr. Harker, in his paper, described an interesting application of the latter, namely, the liquid baths constructed at the National Physical Laboratory for rapidly standardising ordinary high-temperature thermometers. The baths, usually heated electrically, are made up of two parallel vertical tubes, cross-connected top and bottom ; in the one is placed the rotary stirrer and in the other the apparatus to be heated. Between 50° and 220° C., olive oil is employed as the medium, and at higher temperatures—up to 650°—the fused mixture of nitrates already referred to. For maintaining very high temperatures constant, only air baths can at present be used. The heating is now usually electrical, the furnace being a pipe which is either wound with a heating coil or foil, or else through which the current passes direct. To keep the centre of the tube at a uniform temperature, the heating coil is wound more closely at the ends of the tube. At the National Physical Laboratory has been evolved a very useful form of electric furnace, consisting of a carbon tube, on the outside of which a deep spiral is cut. In such and similar furnaces temperatures up to 3,000° C. are obtained. Dr. Bodenstein describes a thermo-regulator that can be used in conjunction with electric tube furnaces in order to maintain a perfectly constant temperature. The expansion of a confined volume of gas—it may be that in the closed iron vessel containing the furnace—moves a column of mercury against a constant gas pressure. The motion of the mercury controls a secondary current superimposed upon the primary heating current, and so corrects for fluctuations in the latter.

Mr. H. C. Greenwood, M.Sc., read a paper on "The Boiling Points of Metals," our knowledge of which is at present very scanty and uncertain. The metals, in considerable quantity, were contained in graphite crucibles, lined with magnesia in the case of metals that attack carbon, which were heated in vertical carbon-tube electric resistance furnaces. In order actually to see when ebullition occurred, observations of the surface of the metal were made from above through an absorbing glass, and it was found that concordant results were obtained when the boiling point was taken at the temperature at which a decided projection of drops from the surface took place. The temperature was observed by means of an optical pyrometer.

The accompanying figure (p. 950) shows a diagrammatic view of the furnace. A B are the water-cooled carbon electrodes ; at C a current of hydrogen was passed in. The furnace tubes are 25 cm. long and 20 to 30 mm. internal diameter. The inner tube usually contained about 30 mm. (equivalent roughly to ¼ lb.) of metal.

The following are the results recorded in the paper :—

Copper	2,310° C.	Magnesium	1,120° C.		
Tin	2,275° C.	Aluminium	1,800° C.	}	Metals attacked by carbon.
Silver	1,955° C.	Manganese	1,900° C.		
Lead	1,525° C.	Chromium	2,200° C.		
Bismuth	1,440° C.	Iron	2,450° C.		
Antimony	1,420° C.				

No previous determinations have been made in the case of the last four metals.

In a further series of experiments, the influence of pressures varying from 10 cm. of mercury to 50 atmospheres on the boiling points of bismuth, copper, lead, silver, tin and zinc, was studied. The apparatus used was much the same as shown above, only the furnace was fitted inside a gas-tight enclosure. The boiling points in all cases increased with pressure, rapidly at first, and then more slowly, following the Ramsay-Young law.

The paper by Mr. A. Blackie, B.A., "On the Behaviour of Silica at High Temperatures," gave an account of experiments made to determine the effect of heat on the strength and devitrification of the opaque and transparent varieties of fused silica. It was found that in the unheated condition the latter was much stronger than the former, but a short amount of heating below 120° C. annealed the opaque variety, materially increasing its strength. Prolonged heating, however, especially above 1,300°, caused devitrification and accompanying loss of strength in both cases. The paper concludes with a description of experiments made to determine the relative coefficients of expansion of opaque and transparent silica. The extremely small coefficient of expansion of fused silica is one of its most valuable industrial qualities, and it turns out to be equally minute in both varieties of the material.

The last paper on the programme was a short description by M. Charles Féry of a new stellar pyrometer. The instrument is, of course, of the radiation type, and is based on a comparison of the colour tint of the star, with that of a standard lamp whose tint can be varied. It is standardised by reference to an electric furnace, an arc (3,500° C.), and the sun (6,500° C.).

Wireless Telegraphy.

By G. MARCONI, D.Sc., M.I.E.E.

(*Abstract of lecture delivered at the* ROYAL INSTITUTION, *June 2nd*, 1911.)

ALTHOUGH we have—or believe we have—all the data necessary for the satisfactory production and reception of electric waves, we are yet far from possessing any very exact knowledge concerning the conditions governing the transmission of these waves through space—especially over what may be termed long distances. Although it is now perfectly easy to design, construct and operate stations capable of satisfactory commercial working over distances up to 2,500 miles, no really clear explanation has yet been given of many absolutely authenticated facts concerning these waves. Some of these hitherto apparent anomalies I shall mention briefly in passing :—

Why is it that when using short waves the distances covered at night are usually enormously greater than those traversed in the daytime, whilst when using much longer waves the range of transmission by day and night is about equal and sometimes even greater by day ?

What explanation has been given of the fact that the night distances obtainable in a north-southerly direction are so much greater than those which can be effected in an east-westerly one ?

Why is it that mountains and land generally should greatly obstruct the propagation of short waves when sunlight is present, and not during the hours of darkness ?

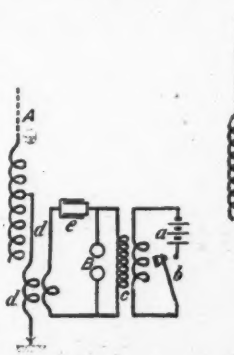


FIG. 1.

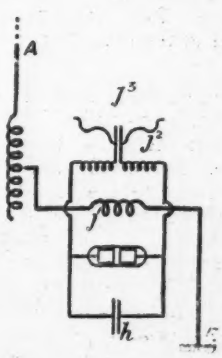


FIG. 2.

In 1900 I first adopted the arrangement which is now in general use, and which consists (as shown in fig. 1) of the inductive association of the elevated radiating wire with a condenser circuit which may be used to store up a considerable amount of electrical energy and impart it at a slow rate to the radiating wire.

As is now well known, the oscillations in a condenser circuit can be made to persist for what is, electrically, a long period of time

and it can be arranged, moreover, that by means of suitable aerials or antennæ these oscillations are radiated into space in the form of a series of waves which, through their cumulative effect, are eminently suitable for enabling good tuning or syntony to be obtained between the transmitter and receiver.

The circuits, consisting of the condenser circuit and the elevated aerial or radiating circuit, were more or less closely coupled to each other. By adjusting the inductance in the elevated conductor, and by the employment of the right value of capacity or inductance required in the condenser circuit, the two circuits were brought into electrical resonance, a condition which I first pointed out as being essential in order to obtain efficient radiation and good tuning.

The receiver (as shown in fig. 2) also consists of an elevated conductor or aerial connected to earth or capacity through an oscillating transformer. The latter also contains the condenser and detector, the circuits being made to have approximately the same electrical time period as that of the transmitter circuits.

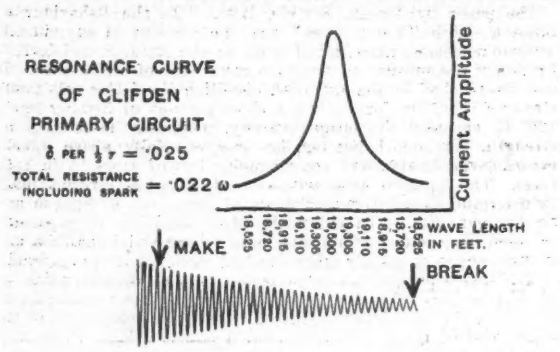


FIG. 3.

At the long-distance station situated at Clifden in Ireland, the arrangement which has given the best results is based substantially upon my syntonic system of 1900, to which have been added numerous improvements.

An important innovation from a practical point of view was the adoption at Clifden and Glace Bay of air condensers composed of insulated metallic plates suspended in air at ordinary pressure. In this manner we greatly reduce the loss of energy which would take place in consequence of dielectric hysteresis were a glass or solid dielectric employed. A very considerable economy in working also results from the absence of dielectric breakages, for, should the potential be so raised as to even produce a discharge from plate to plate across the condenser, this does not permanently affect the value of the dielectric, as air is self-healing, and one of the few commodities which can be replaced at a minimum of cost.

Various arrangements have been tried and tested for obtaining continuous or very prolonged trains of waves, but it has been my experence that, when utilising the best receivers at present available, it is neither economical nor efficient to attempt to make the waves too continuous. Much better results are obtained when groups of waves (fig. 3) are emitted at regular intervals in such manner that their cumulative effect produces a clear musical note in the receiver, which is tuned not only to the periodicity of the electric waves transmitted, but also to their group frequency.

In this manner the receiver may be doubly tuned, with the result that a far greater selectivity can be obtained than by the employment of wave-tuning alone. In fact, it is quite easy to pick up simultaneously different messages transmittted on the same wave length, but syntonised to different group frequencies.

As far as wave tuning goes, very good results—almost as good as are obtainable by means of continuous oscillations—can be achieved with groups of waves, the decrement of which is in each group ·03 or ·04, which means that about 30 or 40 useful oscillations are radiated before their amplitude has become too small to affect the receiver perceptibly. The condenser circuit at Clifden has a decrement of from ·015 to ·03 for fairly long waves.

This persistency of the oscillations has been obtained by the employment of the system shown in fig. 4, which I first described in a patent taken out in September, 1907. This method eliminates almost completely the spark gap and its consequent resistance which, as is well known, is the principal cause of the damping or decay of the waves in the usual transmitting circuit.

The apparatus shown in fig. 4 consists of a metal disk *a*, having copper studs firmly fixed at regular intervals in its periphery and placed transversely to its plane. This disk is caused to rotate very rapidly between two other disks *b* by means of a rapidly revolving electric motor or steam turbine. These side disks are also made to turn round slowly in a plane at right-angles to that of the middle disk. The connections are as illustrated in the figure. The studs are of such length as just to touch the side disks in passing, and thereby bridge the gap between the latter.

With the frequency employed at Clifden, namely, 45,000, when a potential of 15,000 volts is used on the condenser, the spark-gap is practically closed during the time in which one complete oscillation only is taking place, when the peripheral speed of the disk is about 600 ft. a second. The result is that the primary circuit can continue oscillating without material loss by resistance in the spark-gap. Of course, the number of oscillations which can take place is

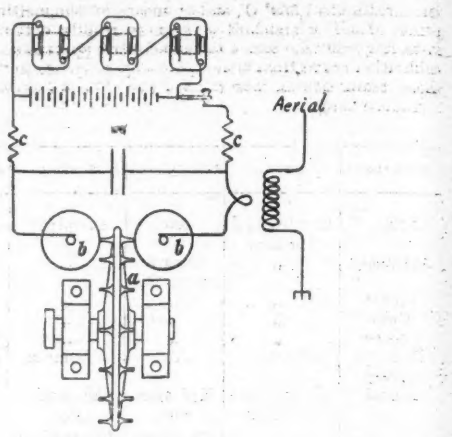


FIG. 4.—DISK DISCHARGER (CONTINUOUS CURRENT).

governed by the breadth or thickness of the side disks, the primary circuit being abruptly opened as soon as the studs attached to the middle disk leave the side disks.

This sudden opening of the primary circuit tends to quench immediately any oscillations which may still persist in the condenser circuit, and this fact carries with it a further and not inconsiderable advantage; for, if the coupling of the condenser circuit to the aerial is of a suitable value, the energy of the primary will have practically all passed to the aerial circuit during the period of time in which the primary condenser circuit is closed by the stud filling the gap between the side disks; but, after this, the opening of the gap at the disks prevents the energy returning to the condenser circuit from the aerial as would happen were the ordinary spark-gap employed. In this manner the usual reaction which would take place between the aerial and the condenser circuit can be obviated, with the result that with this type of discharger, and with a suitable degree of coupling, the energy is radiated from the aerial in the form of a pure wave, the loss from the spark-gap resistance being reduced to a minimum.

I am able to show a resonance curve taken at Clifden, which was obtained from the oscillations in the primary alone (fig. 3).

An interesting feature of the Clifden plant, especially from a practical and engineering point of view, is the regular employment of high-tension direct current for charging the condenser. Continuous current at a potential which is capable of being raised to 20,000 volts is obtained by means of special direct-current generators; these machines charge a storage battery consisting of 6,000 cells all connected in series, and it may be pointed out that this battery is the largest of its kind in existence. The capacity of each cell is 40 ampere-hours. When employing the cells alone the working voltage is from 11,000 to 12,000 volts, and when both the direct-current generators and the battery are used together the potential may be raised to 15,000 volts through utilising the gassing voltage of the storage cells.

For a considerable portion of the day the storage battery alone is employed, with a result that for 16 hours out of the 24 no running machinery need be used for operating the station, with the single exception of the small motor revolving the disk.

The potential to which the condenser is charged reaches 18,000 volts when that of the battery or generators is 12,000. This potential is obtained in consequence of the rise of potential at the condenser plates, brought about by the rush of current through the choking or inductance coils at each charge. These coils are placed between the battery or generator and condenser *c*, fig. 4.

No practical difficulty has been encountered either at Clifden or Glace Bay in regard to the insulation and maintenance of these high-tension storage batteries. Satisfactory insulation has been obtained by dividing the battery into small sets of cells placed on separate stands. These stands are suspended on insulators attached to girders fixed in the ceiling of the battery room. A system of switches, which can all be operated electrically and simultaneously, divides the battery into sections, the potential of each section being low enough to enable the cells to be handled without inconvenience or risk.

The arrangement of aerial adopted at Clifden and Glace Bay is shown in fig. 5. This system, which is based on the result of tests which I first described before the Royal Society in June, 1906, not only makes it possible efficiently to radiate and receive waves of any desired length, but also tends to confine the main portion of the radiation to any desired direction. The limitation of transmission to one direction is not very sharply defined, but, nevertheless, the results obtained are exceedingly useful for practical working.

In a similar manner, by means of these horizontal wires, it is possible to define the bearing or direction of a sending station and

FIG. 5.

also limit the receptivity of the receiver to waves arriving from a given direction.

(To be concluded.)

LEGAL.

MINING PROSECUTION.

BEFORE Sheriff Umpherston, in Dunfermline Sheriff Court, on Thursday last week, William Clarke, pony driver, 179, South Glencraig, admitted having, on May 29th, in No. 1 Pit, Glencraig Colliery, contravened the Electrical Special Rules by going within a fence surrounding an electrical haulage motor, and taking from a receptacle at the side of the motor a quantity of oil for his pit lamp, thus interfering with the working of the motor. MR. J. S. SOUTAR, the prosecutor, stated that it was the first case of the kind he had had under the Electrical Rules. The circumstances were that the lad, having run short of oil for his pit lamp, and having been refused a supply of oil by the man in charge of the motor, went and helped himself to it. The special rules provided that persons not competent and not authorised were to leave these very important pieces of machinery alone and not interfere with them in any way. One could understand how a machine running at a high speed, and supplied with a quantity of oil expected to keep it in good working order until next supervised, if deprived of a quantity of its oil supply might not only heat very exceedingly, and so cause damage to the machinery, but might create friction and sparking, which might lead to a very serious accident. No doubt it was pure stupidity and want of thought of the possible danger that led accused into this position. He hoped the case would act as a warning. The Sheriff imposed a fine of 5s., or three days' imprisonment.

MUNICIPAL COUNCIL OF JOHANNESBURG *v.* D. STEWART AND CO. (1902), LTD., &C.

IN our "Notes" last week we made a brief reference to the opening of this case before Lord Ormidale at Edinburgh. For the following fuller report of the hearing we are indebted to the *Scotsman* of June 7th:—

The action is at the instance of the Municipal Council of Johannesburg, and the defenders are D. Stewart & Co. (1902), Ltd., Glasgow; William Beardmore, shipbuilder and steel manufacturer and another. The pursuers ask declarator that they were entitled to reject, and did on July 5th, 1907, lawfully reject, certain gas producer plant, gas engines, two-phase alternators, direct-current dynamos, balancers, and other goods contracted to be supplied by the defenders D. Stewart & Co. to the pursuers. The pursuers also claim payment from Stewart of sums amounting to £418,694, as damages for breach of contract, and from the other defenders £115,134, being the principal sum contained in a bond dated April 13th, 1907, granted by William Beardmore and the late Joseph Beardmore, as cautioners for D. Stewart & Co. In the year 1904 the pursuers were desirous of introducing a system of electric power and electric lighting to the city of Johannesburg, and in May, 1905, they concluded a contract with the defenders Stewart & Co. to supply and erect the goods, plant, and others necessary for this purpose at a total cost of over £210,000. Messrs. William and Joseph Beardmore were their sureties for the fulfilment of the contract. During 1905, 1906 and 1907 Stewart & Co. delivered certain portions of the plant and proceeded to erect them on the site at Johannesburg. The plant is said to have been disconform to contract. In 1906 Stewart & Co. were in financial difficulties, and in May of that year they intimated to the pursuers that they were unable to perform the work, and abandoned it entirely on May 15th, 1906. The portions of the plant erected on the site were of little or no value to the pursuers, who in July, 1907, rejected the goods, plant, and machinery, and claimed from Stewart & Co. repayment of the instalments of the price which they had paid, amounting to £143,095, and damages for breach of contract.

The defenders (Stewart & Co.) plead that the matter should be dealt with by arbitration, and also that in terms of the contract the matter should be decided by English law and in England. They deny breach of contract, and aver that the installation was made according to the specification of the pursuers, and that any failure of the installation to reach the prescribed tests was due to unsuitability of coal supplied by the pursuers for gas-producing purposes.

Lord Mackenzie, before whom the action originally depended in the Court of Session, sisted the case, in order that the parties might have their disputes settled by arbitration in the manner provided by the contract. His Lordship further held that the validity and scope of the arbitration clause should be settled in the course of the arbitration proceedings. The First Division, on a reclaiming note for the pursuers found that it was necessary for the disposal of the action that it be ascertained whether under the law of England the clauses of arbitration founded on by the defenders covered the dispute between the parties, and the parties were directed to prepare a stated case for the opinion of the English Court. The Division also held that the action against the guarantors fell to be dismissed as premature.

The pursuers appealed to the House of Lords, with the result that the case was remitted to the Court of Session for proof on the grounds (1) that there being an averment that the whole contract had been repudiated by the defenders, it was for the Court of Session to determine whether that was so, and whether, therefore, the arbitration clause could still be appealed to by them; and (2) that in any event, as English law would not compel an English Court to refer the matters falling under these clauses to arbitration, the Court of Session was not bound to refer such matters to arbitration, but had jurisdiction to entertain the whole case. As regarded the claim against the guarantors, the House of Lords reversed the judgment of the First Division, holding that as the bond bore that it was to be regarded as an English bond, it fell to be construed by English law, and that under that law the action was competently laid against the guarantors.

Proof in the case is expected to extend over three weeks, and the productions number 14,644.

Counsel for the Pursuers—Mr. Clyde, K.C.; Mr. Morison, K.C., and Mr Mitchell. Agents—P. Morison & Son, S.S.C.

Counsel for the Defenders—Mr. Murray, K.C.; Mr. Macmillan, and the Hon. Wm. Watson. Agents—Davidson & Syme, W.S.

L.C.C. TRAMWAY COLLISION CASE.

A FIRM of coal merchants secured judgment for £25 damages, at the Westminster Court on Monday, against the L.C.C. for damage done to a motor-car sustained in a collision with a tramcar at Streatham. The negligence of the tramcar-driver was that he was driving within 50 yards of a tramcar in front, contrary to the regulations of the Board of Trade, and that the collision happened in consequence of the breach of this regulation. Counsel for the L.C.C. said that the matter was one for mere infringement of a regulation, the remedy for which was a penalty in police court proceedings, but Judge Woodfall did not agree with this view.

HUGGETT *v.* BLACKBURN PICTURE PALACE CO., LTD.

THIS was a claim for £10 damages for breach of contract, brought at the Blackburn County Court on Tuesday by Harry Huggett, electrician, against the Blackburn Picture Palace Co., Ltd. Mr. H. Backhouse was for the plaintiff, and Mr. Read for the defendants.

PLAINTIFF said he wrote to the defendant company asking for a situation as electrician and operator. He was afterwards seen by Mr. Bradley, managing director, and it was arranged that he should start work at £2 5s. a week for the first three months, and £2 10s. for the following three months. His duties were to include the repairing of the electrical fittings, &c., and operating the cinematograph machine in the evening. The bulk of the time of the day was to be his own. He left a job as electrician at the Blakey Moor School, and commenced work for the defendant company on March 20th. The first day he was dismissed, Mr Bradley having re-engaged the previous operator.

JOHN BRADLEY, managing director of the company, said that claimant was engaged for a month on trial, and if he proved satisfactory he was to go on permanently at the rate that had been mentioned. On the day he commenced work Huggett showed himself to be unaccustomed to the bioscope. When rehearsing the pictures Huggett had them on the floor and when he got them on the screen they were dark. He could see there was going to be no show that evening, so he sent for his former operator to take charge of the operating box for that night. Huggett went away and witness had not seen him since until that day.

HIS HONOUR suggested that the case should be adjourned to give the defendant an opportunity of giving the plaintiff a fair trial, but a dispute arose between the parties as to whether plaintiff was to give part or whole time to the defendant company.

In the end a verdict was given for the defendants.

Hydro-Electric Works in Japan.—It is reported from Yokohama that a large new electric lighting company has been formed in Tokio by the amalgamation of two hydro-electric schemes prepared by the German-Japanese firm of Charter. The company, which has been authorised to use the title of the Nippon Denki Kaisha (Japanese Electric Transmission Co.), has been granted a concession by the Government for 25 years. It is to be a competitor of two companies already in existence, and is prohibited from associating with them for the purpose of establishing a monopoly. The principal shareholders in the company are members of the well-known Japanese banking family of Jasuda.

BUSINESS NOTES.

The Olympia Electrical Exhibition.—When discussing in our pages a few months ago the importance of all doing their utmost to make the Electrical Exhibition of next September very widely known among the general public, we mentioned the value of suitable posters prominently placed in the windows of premises occupied by electrical contractors and others interested generally in the popularity and progress of electricity. We are now, by courtesy of Mr. H. L. Benjamin, the organising manager, enabled to illustrate herewith the poster which has been adopted by the Exhibition Committee. It is proposed to forward copies

of this poster to the supply authorities, contractors, and any others engaged in the electrical industry, who will be willing to prominently display them either in their windows or on their premises a few weeks prior to opening on September 23rd and during the run of the Exhibition. We venture to hope that there will be a very generous co-operation in this matter, both by exhibitors and non-exhibitors.

Coronation Holidays.—THE UNION ELECTRIC CO., LTD., announce the closing of their London offices, works and stores on June 22nd, 23rd and 24th on account of the Coronation Holidays.

MESSRS. POPE'S ELECTRIC LAMP CO., of Willesden, announce that their works will be closed on June 22nd and 23rd in connection with the Coronation holidays, and on June 24th for their annual outing.

Catalogues and Lists.—MESSRS. COX-WALKERS, LTD., Darlington.—A number of illustrated lists so bound as to allow of easy addition of others as issued. They contain illustrated descriptions and prices of the firm's continuous ink-recording electric tell-tales, British-made telephones, magneto-electric bells, "Big Ben" motor turret bells, batteries, automatic starters and regulators, motor-car electric lamps, &c.

MESSRS. W. GEIPEL & CO., St. Thomas Street, London, S.E.—New illustrated price list of Henrion graphite carbon brushes, brushes for tramway motors, carbons for lightning arresters, carbon contacts, battery carbons, &c.

MESSRS. FALK, STADELMANN & CO., LTD., 83-7, Farringdon Road, London, E.C.—Catalogue (No. 313) of 102 pages of illustrations, brief particulars, and prices of electric bells and telephones. All prices quoted have been thoroughly overhauled and are up-to-date, prices of bells and other lines having, in many cases, been reduced, without any alteration of quality. The electric bell section contains no fewer than a dozen different qualities at prices varying from 10d. to £5 each net, so it will be understood how wide and varied a range of goods is covered. The features of the bell list include a cheap sheep gongbell, and the "Farringdon" and "Climax" bells; in regard to indicators, there are eight types in all qualities and prices, including the "Atlas," which is claimed to be a distinct advance in indicator construction. The pushes shown are in brass, china and wood, and there are also new designs in art metal plates. Many types of telephones suitable for domestic and other service, Leclanché batteries at reduced prices, "Delta" dry cells, bell wires (indoor and outdoor), and a selection of "Faradaic" apparatus are among the contents of the book, while there is also a complete set of diagrams showing connections of bells and indicators.

THE ELECTRICAL CO., LTD., 122-124, Charing Cross Road, London, W.C.—New list No. 5 of 40 pages, containing full particulars with tabulated rating, speeds, and so forth of their 110, 220 and 440-volt direct-current dynamos and motors of from ¼ to 100-H.P., motor-starters, motor-generators and converters. Dimension sketches and tables occupy a number of pages.

THE UNION ELECTRIC CO., LTD., Park Street, Southwark, London, S.E.—New catalogue (24 pages) of Union motor-starters and regulators, containing excellent half-tone illustrations of their standard starting rheostats, one-minute starting rheostats, starting and speed-regulating rheostats, (series and shunt regulation respectively), also compound starting, series and shunt-regulating rheostats. Opposite each page of illustrations is fully-tabulated price information of open, semi-enclosed, and water-tight patterns.

THE SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, London, W.C.—Twelve-page catalogue of V.I.R. wires and cables, lead-covered cables, flexible cords, bell and telephone wires and multiple telephone cables. Tabular sizes and prices are given. Leaflets of table and desk fans, and showing the reduced prices for Sun-screwed fittings and boxes, are also issued.

Coronation Arrangements for the Convenience of Contractors.—MESSRS. SIEMENS BROTHERS DYNAMO WORKS, LTD., of Tyssen Street, Dalston, N.E. (Telephone Nos.: Central 8387, 8388, 8389; Dalston 2440 (three lines); Telegraphic Address: "Siemodyn," London), announce that they have made special arrangements to hold their offices and stores at Dalston open during Thursday and Friday, 22nd and 23rd inst., from 9.30 a.m. until the official time of extinction of Coronation illuminations—12.30 a.m. They are holding stocks of lamps and accessories used in connection with Coronation illuminations, and have laid themselves out to attend to contractors' requirements either before the Coronation or on the two days and nights mentioned; they will be prepared, as far as possible, to deliver goods or render assistance in answer to telegraphic or telephonic requests. A section of the Dalston staff will be in attendance at 39, Upper Thames Street (Telephone No. 8270 London Wall, six lines), and, in addition, a staff of engineers will make periodical visits to the illuminations for which Messrs. Siemens are responsible. The London stores (39, Upper Thames Street) will be open until 11 p.m. on Tuesday, June 20th, and all night on Wednesday, 21st inst. These arrangements should be of material assistance to contractors and others interested in Coronation work.

Trade Announcements.—The EFANDEM CO., LTD., electrical and mechanical engineers, of London and Birmingham, are about to erect a new factory at the Fallings Park Garden suburb, near Wolverhampton. The firm expect to employ from 120 to 150 hands by the end of the year.

MESSRS. VICKERS, LTD., announce that their address and registered offices are now Vickers House, Broadway, Westminster, S.W. Telephone: "No. 10110 Gerrard." Telegrams: "Vickers, London."

The partnership hitherto existing between MESSRS. A. E. WOODHOUSE & E. JONES, under the style of the Woodhouse Steel Casing Co., has been dissolved, and the business hitherto carried on by that company has been transferred to the Woodhouse Steel Casing Co., Ltd., of whose registration we published a notice in our last issue.

THE ELECTRICAL APPARATUS CO., LTD., have appointed Mr. Thos. G. Travis, formerly of the Westinghouse Co., to be their Lancashire and Yorkshire representative. We understand that their business in the territory has expanded very considerably during the last 12 months, and Mr. Travis will shortly open the firm's Manchester office.

Owing to increasing business, the SLOAN ELECTRICAL CO., LTD., have removed their Manchester address from Princes Chambers, 16, John Dalton Street, to 16 and 16A, Jackson's Row, Deansgate, Manchester.

Dissolutions and Liquidations.—MESSRS. T. P. SHILLCOCK & CO., electrical engineers, Gothic Arcade, Birmingham. —Messrs. T. P. Shillcock & J. H. Payne have dissolved partnership. Mr. Payne will attend to debts, and continue the business alone.

ENGINEERS' STANDARDISED PUBLICATIONS ASSOCIATION, LTD.—This company is winding up voluntarily, with Mr. J. D. B. Innes, Craven House, Kingsway, W.C., and Mr. J. C. Butler, 23, Powis Square, W., as liquidators.

Book Notices.—*The "Colliery Guardian" Review of the Coal Trade in* 1910 (from the *Colliery Guardian*, price 6d. net) states that during the year the Eight Hours Act has been in operation throughout the whole of the coalfields of the United Kingdom, and has not only complicated working arrangements, but has increased the cost of production. So far, this increase in cost has fallen entirely upon the employer and his workmen, and the struggle to proportion the burden of expense as between these partners in the industry has been responsible mainly for the ill-feeling and perversity for which the year has been remarkable. Hostility to the multiple-shift system necessitated by the Act in Northumberland and Durham led to a prolonged stoppage at many of the largest pits; and in South Wales an embittered controversy was concerned mainly with questions arising out of the Act. The output has suffered in consequence, and the confidence of Continental buyers has been shaken; there are few signs of any permanent revival in the coal trade, and the matters in dispute in the North of England and South Wales are still pressing. The export

of fuel last year reached the lowest point recorded since 1907, though the declared value slightly increased compared with 1909. The evil economic effects of statutory interference between employer and employed have again been demonstrated by the working of the Act.

The Engineering Index Annual for 1910. London: The *Engineering Magazine*. Price 10s. post free.—The merits of this Index have often been brought to the notice of our readers; it now affords a continuous index to the engineering and technical literature of the past 26 years, and the contents are so classified and arranged that it is an easy matter to trace any article, or hunt up all the important articles on any subject coming within the scope of the work. In the present issue reference is further facilitated by a list of catch words, giving at once a clue to the position of the subject under investigation, and saving much time and labour. Not the least of the advantages of this index is its prompt issue annually, while the literature concerned is still fresh. About 250 publications are examined, covering an enormous field; the book is well printed and bound, and we regard it as a most desirable and useful work of reference, of which we have often availed ourselves with satisfactory results.

Electrical Primary Batteries, and *Electrical Accumulators*. By B. E. Jones. London: Cassell & Co., Ltd. Price 1s. net each.—These little books, belonging to the *Work* series of handbooks, are intended to deal in simple practical language with the various forms of primary and secondary cells in ordinary use. The former gives instructions for the setting-up and practical use of cells, with numerous illustrations and particulars as to their construction; the directions given for the handling, cleaning, renewal of solutions, &c., are excellent, and should be of great service in safeguarding the user against the many little pitfalls which surround the primary cell, and which are usually discovered only by unpleasant experience. After dealing with bichromate, Leclanché, Daniell, Edison-Lalande, &c., and dry cells of various types, the Editor shows how cells should be connected up, and gives worked examples of calculations relating to batteries; the use of primary batteries for electric lighting on a small scale, and for charging accumulators is also explained, and minor matters such as switches, pole finders, &c., are dealt with. The second volume gives a short explanation of the principles of the secondary cell, followed by particulars of the construction of typical plates. The erection and mode of starting of a storage battery, and its subsequent maintenance, are treated of at considerable length, and methods of charging batteries from various sources, both D.C. and A.C., are explained. The rest of the book is devoted mainly to descriptions of various types of accumulators. Apart from minor faults, such as the definition of the ampere as a measure of quantity, and the use of the meaningless expression "1,000 watts per hour," both books appear to be very practical and reliable, and likely to be of use to a large circle of readers.

Transactions of the South African Institute of Electrical Engineers. Vol. II, part 3. April, 1911. Johannesburg: The School of Mines Building. Price 2s.

"Boletin de Ingenieros." Vol. 1, No. 9. May, 1911. Mexico: Secretaria de Guerra y Marina.

"The Physical Review." Vol. XXXII, No. 5. May, 1911. Lancaster, Pa.: The *Review* offices.

"*Journal* of the American Society of Mechanical Engineers." June, 1911. Baltimore, Md.: The Society. Price $1.

"Memoirs of the College of Science and Engineering, Kyoto Imperial University." Vol. III, Nos. I, II and III. March and April, 1911. Kyoto, Japan: The University.

"Practical Dynamo and Motor Management." 1911. London: S. Rentell & Co., Ltd. Price 6d. net.

Correction.—In an advertisement of the ELECTRIC AND ORDNANCE ACCESSORIES CO., LTD., appearing in our issue of June 2nd, by a printer's error we described the Vickers 10-ampere Q.B. ironclad combined switch and fuse as quick *firing*. This should, of course, have read quick *wiring*.

Annual Sports.—The third annual athletic sports of the employés of the HART ACCUMULATOR CO., LTD., were held at the Memorial Athletic and Cycle Grounds, Canning Town, on Saturday last, and were more successful than ever. The "gate" was nearly double that of last year. There were 84 competitors, the entries totalling 230 for the 24 events. The cycling events were well contested, and provided better sport than in previous years, H. Taylor's final sprint in the 5-Mile Handicap being specially commented upon. A. Yate was his most dangerous opponent in these events, and himself secured the Mile Race. The running events were also well patronised, the entries for these easily making a record. Mrs. G. W. Kidd (wife of the chairman of directors) presented the prizes. Mr. Kidd, who presided, said that, on behalf of the directors, he thanked those present for their attendance at the sports, and hoped to see an even bigger company next year. The directors were pleased to meet the employés and their families there. It showed there was a good feeling between the men and the directors. He hoped that feeling would continue, as the welfare of the employés was the welfare of the company. A hearty vote of thanks was given to the secretary (Mr. H. R. Soames) and the committee for their work in the arrangement of the sports.

Address Wanted.—A correspondent inquires the present address in London of the Non-Corrosive Electric Tinning Co.

Roumania.—The report by the British Vice-Consul at Constantza, Mr. L. E. Keyser, on the trade of that district in 1910, which will shortly be issued, states that the use of electric light is increasing. The accessories come mainly from Germany and France.—*Board of Trade Journal.*

LIGHTING and POWER NOTES.

Acton.—The Metropolitan Electric Supply Co. has offered to light all the Council's public buildings for the sum of £200 and 2d. per unit. Further information is to be obtained in regard to the proposal, and also as to a counter proposition to light the municipal offices from the baths plant.

Argentina.—The Dolores Electric Light Co., known as "El Cable," has been acquired by the Cia. Alemana Trans-Atlantica de Electricidad for the sum of $340,000.

Bangor.—The City Council has approved of the Lighting Committee's recommendation that the present steam generating plant at the electric light works be replaced by a Diesel engine and dynamo at an estimated cost of £2,000; the L.G.B. is to be asked to sanction the necessary borrowing powers. It is anticipated that the change will result in a total saving to the Corporation of over £340 per annum.

Bootle.—The borough electrical engineer has reported to the Corporation on the necessity to provide additional generating plant, and the Electric Power and Lighting Committee is negotiating for the purchase of land for extension purposes. The Corporation has also before it a scheme for the enlarging the refuse destructor in combination with the electric generating station, the steam-raising plant to supply steam in bulk to the generating plant.

Bournemouth.—The Council is experimenting with both electric and gas lamps for street lighting purposes, and a report is expected in August next.

Bushey.—A conference has been arranged with the Watford U.D.C. upon the subject of electricity supply within the district. The B. of T. has extended the time for the completion of the tramways until August 21st, 1913.

Canada.—The National Hydro-Electric Co., a new syndicate with a capital of $1,000,000, proposes to develop power at Carillon Falls, 35 miles from Montreal. Something like 150,000 H.P. can be obtained by suitable development works, and the power is convenient to Montreal.

The Ontario Hydro-Electric Power Commission having supplied most of the towns west of Toronto with what electric power they required, the Hon. Adam Beck, Power Minister, made arrangements to supply the towns east of Toronto with cheap power also. With this end in view, the Hydro-Electric Commission recently entered into a contract with the Urddington Co.. of New York, for the delivery of 15,000 H.P. to Canadian users in Eastern Ontario. This power at Urddington is on the St. Lawrence Canal system, on the Canadian side at that point. The matter was brought up in the House of Commons, and an inquiry by the engineers of the Department of Railways and Canals was made in consequence, which indicates that, for every 1,000 H.P. developed, the draught of the Rapids Plat Canal will be reduced 1 in. and the efficiency of the whole system be reduced. This aspect of the situation has probably not appealed to the Ontario Government. As the towns of Eastern Ontario are clamouring for power, the Minister is placed in a quandary as to where it can conveniently be obtained.

Canterbury.—The accounts of the electricity undertaking show that there has been during the year 1910-11 a return of about 6¾ per cent. on the capital expended. The gross profit amounts to £4,598, while the net profit, after providing for interest, income-tax, capital repayment and sinking fund of £4,005, amounts to £592. The income of the revenue account was £10,169, as against £9,369 last year. The units sold to private consumers increased by about 5 per cent. The expenditure increased by £787 over that of last year. The figures for 1910-11 are £5,571.

Carlisle.—The Corporation's electricity undertaking has realised a net profit of £3,346, an increase of £200 compared with last year.

Cheltenham.—The R.D.C. has consented to the T.C. supplying current to houses at Prestbury on condition that this shall be without prejudice to its right of action as regards any future applications, and that the giving of the consent shall not constitute the Corporation "undertakers" within the meaning of the Act, so as to render its consent necessary in respect of any application by other undertakers.

Chichester.—The City Council has taken so kindly to electric lighting since it adopted the system in January last for street lighting, that it is now considering the advisability of installing it throughout the Council House buildings. At last week's meeting it was decided to invite tenders for the work in order to ascertain the cost, before deciding definitely on the change. The opinion was expressed that it would save a good deal in decoration of walls and ceilings, and it was also pointed out that all the principal buildings and hotels in the city had transferred their affections from gas to electricity.

The Chichester Electric Light and Power Co. has undertaken to gratuitously illuminate the ancient Market Cross at Chichester on the evening of Coronation Day.

Colchester.—The surplus of the electricity department for the year ended March 31st last was £212, as against £414 in the previous year.

Continental Notes.—WATER-POWER OF THE RHONE.—Some years ago we described the great hydroelectric works erected by the city of Geneva at Chèveres, whence electric power is transmitted to the city over a distance of 9 km.; the city has also in view a scheme for building a dam and works at La Plaine, and another at Chancy, lower down the Rhone, both of which projects will be carried out when the demand for electrical energy justifies their execution. The French portion of the great river also has not been neglected; here a vastly more ambitious scheme has been under consideration during recent years—the transmission of energy from the Swiss frontier to Paris, a distance of about 450 km. (280 miles). For this purpose it would be necessary to erect a huge dam 73 m. high near the hamlet of Genissiat, about 75 km. below Bellegrade, whereby some hundred thousand H.P. would be rendered available. The dam would cause the formation of an artificial lake, but, thanks to the confined course of the river, the raising of the water level would not submerge many inhabited places. The works constructed, or to be constructed, on the Rhone tend more and more to transform its natural fall into a series of level reaches, making a ladder or staircase up to the Lake of Geneva. Naturally, therefore, the idea has taken shape of utilising these steps for internal navigation, a result which would be of great economic importance, as connection would also be effected not only with the lake but also with the navigable network of the Rhine, the valley of the Venoge, Entreroches, Yverdon, the Lakes of Neuchatel and Bienne, the Aar and Basle, thus opening a large number of outlets for international traffic.

ITALY.—A Milan syndicate has drawn up a scheme to put down a plant to utilise the water-power of the river Avisie, in the Southern Tyrol, in the generation of electrical energy for lighting and power purposes in the district. It is estimated that no less than 60,000 H.P. is available.

Crewe.—The profit on the electric light undertaking for the past year amounts to £1,268, as against £1,478 for the previous year. The Corporation proposes to make in the near future an alteration in the lighting of the whole of the streets of the borough.

Devonport.—At a meeting of the T.C. recently, Alderman Love, submitting the report of the Electricity Committee, said there was a net balance of £26. There had been a reduction in the price of current to all classes of consumers, which amounted to a difference of £725; and they had contributed to the rates £833 this year, as against £445 last year. The Committee recommended that the £26 be put to the reserve fund, which after paying £1,540 for the mechanical stokers, would then stand at £8,351.

Durham.—The T.C. proposes to utilise electricity for its screening apparatus in the pump well at the sewage works. The County of Durham Electric Power Distribution Co. has offered to lay the necessary mains and provide a motor, gear wheels, &c., for £46, and to supply current at an estimated charge of £35 per annum.

Farnham.—The Farnham Gas and Electricity Co., Ltd., has made certain proposals to the Urban Council as to the supply of electric power for the sewage pumping station which are being considered with tenders for the installation of a suction gas plant. The company has quoted an inclusive price per quarter for the necessary motors and current to do all the pumping required, upon data supplied to it, and will be able to supply the power during the next 12 months. Mr. Barnard (a member of the Council) remarked that they must walk warily in the matter, because they knew suction gas plants had been pulled out in the neighbourhood. It was decided to engage expert advice on the Gas and Electricity Co.'s proposals.

Farnworth.—According to Mr. Richardson, chairman of the Electricity Committee, the expenditure during the past year on the electricity undertaking had decreased from £4,652 to £3,778. The loss on the undertaking has been brought down from £876 to £376.

Gellygaer.—The U.D.C. on June 7th rejected, by 8 votes to 3, a recommendation that the Isolation Hospital should be lighted by gas. The Rhymney Valley Electrical Supply Co. had offered to wire the building for 172 lights on the Council paying £350 towards the cost, and to supply current at 4d. per unit. The Council now proposes to install its own plant, and information as to the cost, &c., is to be obtained.

Glasgow.—At the last meeting of the T.C. Committee on Electricity, it was reported that the treasurer stated that he had paid to the Corporation loans fund the sum of £10,000 to account of capital account, reducing the total amount borrowed as at 31st ult. to £1 960,000. At the same meeting the chairman, Councillor Smith, was authorised to sign a cheque in favour of the Corporation loans fund for the sum of £8,850, the amount payable to the Electricity Department sinking fund for the year to 31st inst., being 1 per cent. in respect of £885,000 borrowed on behalf of this department under the gas borrowing powers contained in the Glasgow Corporation Gas Act, 1869, and the Glasgow Corporation (Sewage, &c.) Act, 1898.

Hazel Grove and Bramall.—The Stockport T.C., having received a request for a supply of current from Bramall, has replied that it has no power to supply electricity in the area of the U.D.C.

Immingham Dock.—At the new Great Central Railway dock at Immingham, where the company anticipates handling a very large coal traffic, a permanent power house is being established for the supply of both hydraulic and electrical power. The electrical plant consists of three B.T.-H. turbo-generators, one of 500 KW. and two of 250 KW. each. These will supply energy to the Immingham and Grimsby Tramway and to the dock estates in both places.

Kent Collieries.—In connection with the Tilmanstone pits of the East Kent Colliery Co., arrangements are being made for duplicating the steam pumping plant by the installation of two horizontal high-lift centrifugal pumps, electrically driven; two high-lift vertical electrical sinking pumps are also being installed, each to be suspended and handled by a 40-ton single-drum winch. For providing the necessary electrical energy for surface and underground works, two Westinghouse turbo-alternators, giving together 1,200 KW. (three-phase, 3,000 volts, 50 cycles), are being provided, with Leblanc condensing plant, and supplied with steam from four Babcock boilers, working at 200 lb. per sq. in. pressure.

Korea.—A company has lately been formed at Phyongyang with a capital of £30,000, to establish a central electric lighting station in the town.

Limerick.—At a recent meeting of the Electric Lighting Committee, it was decided to recommend the Borough Committee to apply for a loan of £7,000 to be devoted towards the improvement of the plant, &c., at the electric supply power house.

Lincoln.—At Tuesday's meeting of the Council, Mr. W. S. White moved the adoption of the Electricity Committee's report, pointing out that the year ended March 31st had proved a record. The gross profit amounted to £7,292. From that had to be deducted £3,969 for interest and sinking fund, leaving a net profit of £3,323, or an increase of £820 on the previous year.

London.—BATTERSEA.—The Highways Committee of the B.C. has decided to replace 432 arc lamps for street lighting by a globe containing five metal-filament lamps. The charge for lighting will be reduced from £18 to £15 per lamp per annum—a saving of £1,296 a year. The cost of conversion is estimated at £1,368.

Manchester.—The annual abstract of accounts of the Manchester electricity department shows a surplus on the year's working of £27,573, of which sum £15,000 has been disposed of by grant in aid of the rates, and the remainder in defraying the cost of special renewals. The renewals suspense account has been augmented by an amount carried from revenue account, being the calculated amount for the year, and by bank interest. The net aggregation is £25,450. The account is still below the proper standard. To permit of the expansion of business various additional borrowing powers, amounting to £70,000, have been secured during the year. On capital account the total outlay now reaches £2,733,207. The mortgage debenture stands at £1,949,583. The annual sales of energy now total over 83 million units.

Middlesbrough.—The net profit for 1910-11 amounted to £2,079, as compared with £1,296 in the previous year. The number of consumers increased from 1,112 to 1,257, and the output sold from 1,810,877 to 2,021,586 units.

Newcastle-under-Lyme.—The T.C. has applied to the L.G.B. for a loan of £5,400 for extensions of plant at the electricity works.

Nottingham.—At Monday's meeting of the City Council, Alderman Sir John Turney (chairman) moved the adoption of the annual report of the Electricity Committee, from which it appeared that there was a total H.P. at the three generating stations of 17,345, viz., 8,925 at Talbot Street, 7,700 at St. Ann's, and 720 at the Eastcroft destructor. The demand for electricity for power purposes was maintained. 3,835,876 units were sold for lighting, 2,526,727 for power, and 5,681,924 for traction, the total of 11,944,527 units representing an increase of 474,792. Rather more than 52 per cent. of the units for private lighting were at the reduced rate of 1½d. per unit. The revenue account showed a total expenditure of £52,010. Sales of energy realised £91,915; and the rent of meters £1,748, and £42,872 was carried to net revenue account. £13,337 had been expended in repayment of loans, and £15,350 paid in aid of the district rate. In his speech, Sir John Turney said the reason they had not done so well in 1910 as in the previous year was because charges had been made over which they had no control. The sum taken out of the concern towards the government and management of the city included the £15,300, and also increased charges for local rates together with other charges, the total being £26,990. Their reserve fund was not as large as it should be, and the time had come when the Finance Committee should cease taking practically all that the undertaking earned after all charges had been met. The reserve fund stood at £48,000, bringing in £1,400 a year. The Finance Committee had even taken possession of that.

Parkeston Quay.—According to the *Daily Express*, the Great Eastern Railway Co. has adopted a scheme of electrical transporters for coaling their steamers at Parkeston Quay; previously this work had been carried out by hand.

Penmaenmawr.—The B. of T. has informed the U.D.C. that it has deferred the question of revoking the E.L. order.

Redditch.—The U.D.C. has applied to the L.G.B. for a loan of £5,850 for additional plant at the electricity works.

Runcorn and Widnes.—The Mersey Power Co., Ltd., announces that a supply of current for lighting and power will shortly be available in Runcorn and Widnes. The company has arranged a special wiring department for carrying out installations.

Salford.—The Corporation proposes to adopt an improved method of lighting in Regent Road, at an estimated cost of over £2,000.

Sandiacre.—At a meeting of the Parish Council on Monday, the Clerk read a letter from the Long Eaton U.D.C. stating that application had been made to that body for a supply of electricity to premises situated within the Sandiacre district. The Long Eaton authority desired consent in accordance with the Electric Lighting Act, 1909. Mr. R. Doncaster objected to Sandiacre being exploited for the benefit of a neighbouring authority. The Council declined to grant the application.

St. Helens.—The Mayor, speaking at the meeting of the T.C. on June 7th, said there had been a large increase in the output of electricity during the past year, the total being 4,138,000 units, an increase of 1,359,000 compared with that of the previous year. Energy supplied for lighting increased from 420,000 to 454,000; for power, from 916,000 to 2,115,000, or 130 per cent.; and for tramways, from 1,444,000 to 1,569,000. Cost of production had been reduced from 0·66d. to 0·64d. per unit. The total income amounted to £23,827, an increase over the previous year of £3,695, but owing to the heavy expenditure on repairs to plant necessary to meet the greatly increased demand, for which the new turbo-alternator was not then available, the working expenses had gone up considerably. The gross profits amounted to £10,636, which is a return of 6¼ per cent. on the capital.

The T.C. has applied to the B. of T. for sanction to supply energy for power purposes to the Sutton Moss Peat Works, at a pressure of 400 volts by means of overhead feeders.

South Shields.—At a meeting of the T.C. on 7th inst., it was reported that the L.G.B. had sanctioned the borrowing of the amount required for the provision of additional plant at the electricity works. It was stated that when this new plant was installed it would enable the committee to carry on the supply without further extension for a considerable time.

Swansea.—The balance-sheet of the electricity undertaking for the year ended March 31st last shows total revenue, £26,320; expenditure, £13,542; gross profit transferred to net revenue account, £12,778, being an increase of £500 as compared with last year. The net profit was £2,802, showing an increase of £80, compared with the result of the working for the previous year. Owing to the increased assessment, the amount paid in rates was £1,638, as against £799. The balance in hand was £8,062.

Walsall.—Sanction has been received from the L.G.B. to the borrowing of £17,840 for the electricity undertaking, less £3,330 in respect of superseded plant and buildings. The Electricity Committee has refused an offer from a local firm of manufacturers to take power required for its works from the Corporation (instead of putting in its own power plant) at a flat rate of ½d. per unit, as, the Committee states, the existing scale for the supply of three-phase alternating current is so low that it will only give a bare margin of profit to the Corporation. The Electricity Committee also reports that it was expected that the supply for lighting Bloxwich would be available within a few weeks, and it had instructed the assistant engineer to arrange for the canvassing of the district with a view to securing customers.

Warrington.—The income of the electricity department for the year was £19,385, and the expenditure was £10,512. After deducting contributions to the sinking fund and interest, there remained a net profit of £2,667. Of this £2,196 will form a nucleus of a working balance. The reserve fund now stands at £9,358.

Wharfedale.—The proposal to institute an electrical supply to numerous places in Wharfedale (Yorks.) appears to be advancing. A firm of Otley solicitors, together with the engineer of a company which is in process of formation, are interviewing local authorities with the object of obtaining the approval of and moral support to the scheme, and two or three bodies have already passed favourable resolutions. The maximum charges proposed under the scheme are 5d. per unit for lighting purposes and from 2d. to 4d. per unit (according to use) for power, and clauses giving the option of purchase to the local authorities are to be included in the Parliamentary Bill. Statutory notices are to be issued during the ensuing month.

Whitby.—The U.D.C. has decided to apply to the Board of Trade for consent to use overhead electric cables in different parts of the town.

Wimbledon.—The Council has decided that the charge for current supplied to consumers in the Urban District of Maldens and Coombe, be as follows:—6d. per unit for lighting; 2d. per unit for power or heating, and that the charge for meters be 1s. per quarter for a meter not exceeding 25 amperes, and 2s. 6d. per quarter for a meter exceeding 25 amperes. Application is to be made to the L.G.B. for sanction to borrow £5,970, being the estimated amount required until March, 1914, for the following:—Mains and house services, £4,225; meters, £895; transformer sub-stations, £850. The Wimbledon Traders' Association are to be informed that current for the external lighting of business premises in Wimbledon and Merton will be supplied at the rate of 3d. per unit, as registered by a separate meter to be supplied and fixed at the expense of the Council, provided that applications for a supply amounting in the aggregate to not less than 100,000 units per annum, are received not later than July 31st next. The Arc Engraving Co., Ltd., asked for a uniform charge of 1d. per unit for all energy supplied to their factory in Ashcombe Road, and offered to guarantee a minimum consumption of 20,000 units per annum; the power rate in force for the time being is to be charged for all energy supplied to the company as from January 1st last. A Sub-Committee has been appointed to meet Messrs. Handcock and Dykes representing the Fixed Price Light Co., to discuss the question of an arrangement between the Corporation and the company for the supply of energy to private houses for lighting purposes at a fixed price per annum.

Worcester.—The working of the electricity department for the last financial year resulted in a deficit of £760. This was anticipated, as in addition to an estimated deficit of £400, a good deal of expenditure has occurred out of revenue on street lighting, &c.

The engineer reports that the Powick water-power station has given a very satisfactory output, and recommends that this source of power should be further developed.

York.—The L.G.B. has sanctioned a loan of £10,700 for E.L. purposes. In sending consent, the Board urged upon the T.C. the necessity for the establishment of a reserve or depreciation fund, in order to provide for the renewal or replacement of plant as it becomes worn-out or obsolete.

TRAMWAY and RAILWAY NOTES.

Australia.—A report on the construction of municipal tramways has been furnished to the Perth (W.A.) City Council by Mr. Edmiston, electrician. This points out that fairly good routes can be obtained which will avoid the routes of the existing company, and outlines 13½ miles of tramway which, with rolling stock, car-sheds, power house and electrical equipment, would cost some £179,394. This excludes the cost of land, street widening and legal expenses.

British Electrical Federation.—The Federation, after lengthy inquiries, has decided in favour of the Bremen system of railless electric traction (see page 909), which may be adopted in the event of rural and extra-suburban extensions to its various tramway undertakings.

Burnley.—The tenth annual report of the Corporation tramways department states that the result for the year must be regarded as very satisfactory. The actual revenue increase for passengers was £168 and for parcels £106, whilst the expenditure showed an increase of £1,004. "The relaying of the permanent way has begun, and it may be expected to go on year by year until the whole is relayed," adds the manager. The reserve fund now stands at £46,096. The number of passengers carried was 13,107,830, an increase of 196,717. The income from all sources was £65,817 against £65,525, whilst the expenditure was £42,574 against £41,570. There had been a gross profit of £23,243, and a net profit of £9,048, which is to be allocated as follows:—To reserve fund £5,000, and to relief of rates £4,048. The construction of top-covered cars has been so successful that it has been decided to cover the remaining 21 cars.

Congo.—H.M. Consul at Boma (Mr. H. G. Mackie) reports that a scheme is on foot for building an electric railway from Matadi to the neighbouring hills, to enable the Europeans to live out of the town, where the climate is excessively hot.—*Board of Trade Journal.*

Continental Notes.—GERMANY.—The Rhenisch Westfalische Elec. Ges. has secured a concession for the construction and working of an electric tramway in the town of Solingnen.

HOLLAND.—A scheme is under consideration for the construction of an electrical light railway between the Hague and Leiden *via* Wassenaer, a distance of about 11 miles.

SPAIN.—Don Fernando Garcia Gongora, of Malaga, is to carry out surveying operations relative to the construction of an overhead electric tramway in the town of Malaga. Eight months are allowed for the drawing up of the plans.—*Board of Trade Journal.*

SWITZERLAND.—The inauguration has just taken place of the Berne power station in the Berne Highland, the water power of the Kander being utilised for the operation of turbo-generators of from 9,000 to 12,000 H.P. It is intended to use the power in the form of high-pressure single-phase alternating current for the working of the Lotschberg railway, and perhaps also for other lines. It is assumed that the Federal Railway authorities will soon approach the question of the conversion of the St. Gothard Railway to electric traction, as otherwise almost the whole stream of tourist traffic will presumably be diverted to the new Lotschberg-Simplon Railway in consequence of the inconveniences arising, it is said, from the presence of soot on the former railway, especially as the latter line represents a considerable reduction in the distance to Italy and the Riveria from the north and north-west of Europe.

Glasgow.—In connection with the agitation by the motormen and conductors on the tramway system for a 48-hours week instead of 54, with a 14-days' holiday with pay instead of five days, the general manager has issued an important report. It points out that in 1905 and 1907 the maximum wage, as at present, was fixed under which employés started the first year at 24s. per week, and rose by gradation until in the third year 29s. was reached, with 30s. in the fourth year, 31s. in the fifth year, and 32s. thereafter. On inquiry at 85 municipal systems, the general manager now reports that there are no tramway systems in the country with less than a 54-hours working week; that Glasgow was the only system on which the average number of hours actually spent on a car worked out at under 50 per week; that on the length of "spread over" the average length in Glasgow was 11 hours 36 minutes. As to spare men, the manager reports that he was not aware of any other system in which such employés started at once on full wages and received the advances regularly, rising to the maximum, while they were on the spare list. Dealing with the whole Glasgow system, the manager points out that he has found that the "average working day, leaving the workmen's or early morning cars out of account, is 8 hours 46 minutes, and that the average time actually spent on the car by each man is 8 hours 10 minutes. If the early morning cars are included, the average time actually spent on the cars daily is reduced to 8 hours 8 minutes." Dealing with wages, allowances, &c., the manager points out that all spare men are paid full wages, whether employed or not; are provided with full summer and winter uniform; have free travelling on the cars going to and from duty, and are paid full wages during period of training, not only as conductors but also as motormen. Motormen who are free from accidents for which they can be held blameworthy for 26 consecutive weeks, get 1s. per week of a bonus; 92 per cent. of the motormen earn this bonus. The Corporation contributes 4d. per week per member to the Men's Friendly Society and Superannuation Fund. The men have admitted that these conditions are equal to a steady weekly wage of at least 36s. In committee certain increases of salary of 2d. per day for motormen-conductors of three years' service and over were approved, but amendments for a 51 hours week, with five-hour shifts and seven days' holiday per annum, with pay, were negatived on divisions.

The T.C. Committee, on June 13th, had the abstract statement of the previous year's income and expenditure before it, which showed that on the 12 months' working there was a surplus of £68,678, or an increase of £15,650 on the previous year. It was pointed out that the revenue for 1910-11, amounting in all to £949,489, compared very favourably with that for 1909-10, when the income was £896,720. On all the items of expenditure increases, however, are to be noted—the total expenditure for 1910-11 being £533,179 compared with £502,911 in 1909-10. Interest, &c., amounted to £44,444, against £37,740 in 1909-10, and the balance in the respective years was £431,549 in 1909-10 and £459,754 in 1910-11. From this, however, fell to be deducted certain items, amounting in all to £391,076 this year, compared with £378,521 in 1909-10.

Lincoln.—The Corporation tramway undertaking shows a gross profit of £2,447. Repayment of loans and interest absorbed £2,600, so that there was a deficiency of £153, which had to be provided for out of the profit on the electricity undertaking. The reserve fund amounts to £8,628. Altogether there were carried 1,649,000 passengers during the year, and there had been no accident.

Newcastle-on-Tyne.—A strike is threatened among the tramway men. Members of the Tramway Workers' Union have issued an ultimatum to the Corporation Committee that unless that body agrees to receive a deputation, of which the secretary, Mr. J. Tate, shall be one, for the purpose of discussing grievances, preparations will be made to force the matter to an issue. Too long hours is said to be one grievance, some of the men stating that they are kept on duty for 30 hours. It is also claimed that the speed of the cars is excessive.

Nottingham.—The Tramways Committee in its annual report states that 100 cars are now fitted with top covers, and the provision of covers for the remainder is proceeding as rapidly as possible. The receipts, exclusive of interest on investments, amounted to £157,289, an increase of £2,354. The average per mile was 11·13d., or exactly the same as for the previous year. The working expenses amounted to £104,085, an increase of £5,922, the average per mile being 7·37d., compared with 7·06d. for the previous year. The balance, amounting to £53,204, has been disposed of as follows:—To interest on stock and loans, £15,564; repayment of capital, £18,822; reserve and renewal fund, £3,817; and in aid of the general district rate, £15,000. The reserve and renewals fund, including interest on investments, now amounts to £68,069. The rateable value having been increased by the Assessment Committee from £19,355 to £22,355, the sum paid in rates for the year amounted to £9,221, as compared with £7,903 for the previous year. The cars and 'buses ran a total of 3,388,740 miles; the number of passengers carried was 35,259,067, an increase of 611,829.

In moving the adoption of the report, Councillor Swain (chairman) referred to the success which had attended the introduction of the 1½d. fares. Tickets of this kind to the number of 407,000 had already been issued. The receipts of £157,289 were, said Mr. Swain, particularly gratifying to the committee, considering that in last year's account they had two Easter weeks. This year would be a record one as far as carrying the public was concerned, even remembering last year's big increase of 611,000. The report was adopted.

South Shields.—At a meeting of the T.C. on the 7th inst., Alderman Wylie, in moving the adoption of the Tramway Committee's report, which included the manager's annual report, stated that the committee had been able to carry forward a balance of £2,400. The Committee proposed to start an insurance fund to which it suggested the Council should place £500. It recommended that the profit balance should be placed to the reserve fund, which would bring it up to about £10,000. As to the running powers granted to the Jarrow and District Co., the Corporation was at present paying the company 3·6d. per car-mile for the company's cars running in the borough area; the company paying the fares to the Corporation. The company had offered to accept 3·4d. as a compromise, but the Committee could not see its way to pay more than 3·25d., which was a trifle more than the cost of running the cars. The report was adopted.

Stalybridge.—On Wednesday last week, Lieut.-Col. Von Donop held an inquiry at Stalybridge into the accident at Ditchcroft, in which 40 people were injured.

Driver Napper, who drove the ill-fated car, said he had been a driver eight years, and previous to coming to Stalybridge he was a driver on the Potteries Electric Traction System, which he left 10 months ago. He was aware the cars were fitted with the Westinghouse magnetic brake. On June 5th he came on duty at 4.40 a.m., and tested the brakes, and was satisfied they were then in order. Detailing the journey from the top of the hill, he said he put on the first notch of power, and the car went slowly and gradually gained speed. He then dropped sand and applied the magnetic brake. The rails were very moist; he continued to drop sand, and put the magnetic brake to the second, third and fourth notch. The car kept going and gaining speed; he could not pull up, and travelled past the second compulsory stop. Neither the brakes nor the sand appeared to have any effect. The passengers on the top got very excited, and went to the right side of the car as it was going round the corner. Then it overbalanced on that side and he was thrown violently over the front. When he applied the magnetic brake, he thought the wheels were revolving; he was sure the magnetic brake did not act, but on the first journey that morning the magnetic brake had acted all right. He applied power to get the necessary speed for the application of the magnetic brake.

John Burke, of Stalybridge, a passenger on the car, said it did not stop at the first compulsory stop at the top of the hill.

Thos. Clarke corroborated. When the car reached the street in going down the hill, the trolley came off and the speed increased.

Geo. Grundy, the shed foreman, said he tried the brakes in the evening, and they acted perfectly. He found nothing to account for the failure of the brake before the accident. The life of the wheels was about two years, or 60,000 miles. The hand brake had that morning held the car.

Several witnesses said the car did not stop at the top of the hill.

The Inspector said it was possible he would have to reopen the case. If further evidence was found, it would, no doubt, be forwarded to him. He would inspect the car, but the present inquiry would be closed.

U.S.A.—According to *Electric Traction Weekly*, all the Chicago elevated railways have agreed to terms for merging their interests in a company to be known as the Chicago Elevated Railways. The properties covered are valued at about $90,000,000, and cover 172 miles of track. A syndicate has prepared plans for a subway system in the city, but this is apparently in opposition to the ideas of municipal ownership favoured by the city authorities.

The Southern Pacific Railway Co.'s new power house at Friutvale, Cal., has recently been opened. The station contains about 40,000 H.P. of plant, and will be sufficient to operate all the electric trains which the company proposes to run in and round San Francisco.

Wakefield.—The Wakefield and District Light Railway Co. has given notice under Sec. 34, Sub-sec. 2, of the Wakefield and District Light Railway Order, 1901, of its intention to lay down a double line of rails, in place of the present single line, from Wakefield Bridge along the Doncaster Road, to the Calder and Hebble Bridge, making junctions with the existing double tracks at these points. The necessary plans have been deposited with the Corporation.

Warrington.—The income from the Corporation tramways last year was £2,656, and the net profit £2,344. There was an increase of £506 in the passenger receipts; of the profits, £2,000 goes in relief of the rates. The debt extinguished to date is £22,572.

TELEGRAPH and TELEPHONE NOTES.

Glasgow.—Councillors James Alexander and D. M. Stevenson have reported to the Telephone Control and Charges Committee of the T.C., in connection with an interview with the Postmaster-General in London, that when Mr. Samuel was strongly pressed to leave the door open for a further experiment in local control, to enlarge the boundaries of local service areas, and to extend to new subscribers who had joined the system since 1907 the option of having telephone facilities on the same terms as old subscribers, he admitted the injustice of the present position of new subscribers, but questioned if a concession which might be

taken from them within two years would be appreciated; explained, with regard to payments for wayleaves and easements, the statutory powers of the Post Office as to the opening-up of streets, and expressed the view that his department could not be expected to continue these payments; admitted that the present measured service rate was excessive, but hoped to see his way to make a considerable reduction thereon; and appeared surprised that old subscribers were being asked to adopt the measured-service rate whenever they had occasion to make changes in their installations, and stated that such a practice was not in accordance with the intentions of his department. The T.C.'s Committee approved of the report.

Greenwich Time Signals.—Referring to the note in our last issue regarding the reduced charges for time signals from Greenwich, we are informed that the Silent Electric Clock Co. are also in a position to supply receiving apparatus approved by the Post Office.

Japan.—A Telephone Extension Investigation Committee has recently been sitting in Tokio. The Vice-Minister of Communications stated that at the end of the last fiscal year the telephone offices numbered 703, and the subscribers over 128,000. The demand for telephones was rapidly increasing, and the telephones remaining uninstalled numbered as many as 66,000. The second extension scheme was to be completed in the course of the next fiscal year, but the Government found it necessary to consider a third extension to meet the present requirements, and the Committee was consequently called upon to investigate and report on the scheme.

Switzerland.—The telephone is making great progress in Switzerland; at the end of 1910 there was one station to every 48 inhabitants, and the number of subscribers rose from 63,800 in 1909, to 67,500 in 1910, while the number of apparatus rose from 73,400 to 78,500.

The Telefunken System of Wireless Telegraphy.—The exclusive rights of the Telefunken system, developed by the Gesellschaft für Drahtlose Telegraphie, of Berlin, for the United Kingdom and some of the British Colonies have been acquired by Messrs. Siemens Bros. & Co., Ltd, who are now in a position to tender for stations suitable for all purposes, and to contract for the supply of complete telegraphic services under their own control on board ships. A pamphlet describing the system has just been issued by the firm, in which the history of the system—a combination of the Braun-Siemens and Slaby-Arco systems—is outlined, and the original Telefunken system is described; the latter has been superseded by the "singing-quenched-spark" Telefunken system, of which a long and detailed account is also given. It is stated that the number of stations equipped on the old system up to January, 1909, was 673, and by July, 1910, 161 stations on the new system had been added, making a total of 834 (not including German stations). Amongst other large undertakings being carried out on the Telefunken system is a line of 10 stations across South America, from Para to Lima, a distance of 4,000 km.; of these, five are already working. The pamphlet is profusely illustrated and admirably produced.

The Telefunken system in South Africa is in the hands of the A.E.G. Electrical Co. of South Africa, Ltd., who have issued a similar brochure, covering the same ground.

United States.—It is reported that the Postal Telegraph Co. has installed two new lines between Salt Lake City and San Francisco, weighing 435 lb. to the mile, which are capable of use as both telephone and telegraph lines, and have cost £200,000.

West Africa.—A system of wireless telegraphy is to be carried out in the Congo State, following the course of the Congo up to the Katanga district for a distance of 1,860 miles; transmitting stations are to be erected in all the principal places. The apparatus of the Radio-Electrique as used in the French possessions will be employed in the neighbourhood of the French Colonies, whilst the usual apparatus of the Telefunken Gesellschaft will be used in the vicinity of the German Colonies. It is proposed to endeavour to reach an understanding with France and Germany with regard to the wave length, in order to bring the whole system into agreement. Telefunken stations are to be established at Tabora and Udjidji, in German East Africa, and French stations are to be erected at Loango and Brazzaville. It will therefore be possible to telegraph through the whole of the African Continent from the port of Dar-es-Salam and thus obtain a connection with Europe through a cable on the West Coast.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—VICTORIA.—P.M.G.; 150 miles insulated wire and five miles of telegraph cable. See "Official Notices" to-day.

July 19th.—Insulators, telephones, copper wire and iron wire, for the P.M.G.'s Department in Queensland. See "Official Notices" June 2nd.

BRISBANE.—July 19th. 199 tons of copper wire, and 180,000 porcelain insulators for the P.M.G.'s Department. High Commissioner's office, 72, Victoria Street, S.W. and Board of Trade C.I. Department, E.C.

June 27th.—1,400 protectors for use on main distributing frames at magneto exchanges, for the P.M.G.'s Department in Victoria. See "Official Notices" May 5th.

July 25th.—Deputy-P.M.G., Melbourne. Twelve sections of a branching multiple magneto lamp-signalling switchboard, &c., or one automatic or semi-automatic switchboard, for the P.M.G.'s Department in Victoria. See "Official Notices" March 24th.

MELBOURNE.—P.M.G.'s Department. July 25th: Various telephone switchboards and parts. August 1st and 8th: 150 miles of insulated wire, and 5 miles of paper-insulated lead-covered telegraph cable with screened conductors. Specifications may be seen at the Board of Trade Commercial Intelligence Department, London.

BRISBANE.—January 30th, 1912. For the Metropolitan Water and Sewage Board:—One, two or three complete units, consisting of power-generating plant or plants, and pump or pumps, to raise from the suction wells through the delivery mains, through a total vertical lift of 400 ft., exclusive of the head due to friction, &c., not less than 6,000,000 British imperial gallons per day of 24 hours. Particulars from Mr. G. Johnston, secretary, office of the Board, Albert Street, Brisbane, Queensland.

Belgium.—June 20th. The municipal authorities of Ixelles-lez-Bruxelles are inviting tenders for the supply of the armoured cables and high-tension three-phase feeders required in connection with the electric lighting undertaking. Tenders are to be sent to the Hotel Communal, Ixelles, Brussels.

Birmingham.—June 26th. General stores for the Corporation Electric Supply Department for a year. Mr. Chattock, city electrical engineer.

Brackenhill.—July 8th. Construction of 3 miles of light railway, for the Brackenhill Light Railway Co. C. F. Benough, engineer, York.

Buxton.—June 17th. Small nuts or slack for a year, for the U.D.C. Electricity Works. The Engineer.

Charleville, co. Cork.—June 30th. Suction gas plant, engine and generator, storage battery, &c., switchgear, overhead lines and street lamp fittings, for the Charleville Electric Co. See "Official Notices" to-day.

Egypt.—The date for sending in tenders for complete electric pumping installation to the Ministry of Public Works at Cairo has been extended to June 24th.

Govan.—June 27th. Steam and other piping, switchboard extensions, boiler, stoker, coal bunkers, and cooling tower, for the burgh electricity department. See "Official Notices" to-day.

Hull.—June 20th. Electric light installation, fittings, and fans, Southcoates Lane Schools, for the T.C. J. H. Hirst, city architect, Town Hall.

June 26th.—Cables and two water-tube boilers, for the Hull Corporation Electricity Department. See "Official Notices" to-day.

Ipswich.—June 30th. Alterations to switchboard and other electrical plant, at the workhouse, for the B. of G. See "Official Notices" to-day.

London.—July 4th. Four electric traversers for carsheds. See "Official Notices" May 26th.

POPLAR.—June 19th. One 3,000-KW. turbine alternator, with surface condensing plant, two water-tube boilers with superheaters, air heaters, fans and chimneys, one 30-ton electric overhead travelling crane and water-softening plant, for the B.C. See "Official Notices" May 26th.

June 30th.—Surface condensing plant at the South Kensington generating station, for H.M. Office of Works. See "Official Notices" June 2nd.

HAMMERSMITH. June 21st and 30th. (1) Wrought-iron flues, (2) 600 time switches for individual street lamps, for the B.C. See "Official Notices" to-day.

Londonderry.—July 7th. Wiring, fittings, &c., for the new Guildhall lighting for the Corporation. See "Official Notices" to-day.

New Zealand.—August 14th. Overhead tramway material, feeders, &c., for the Gonville and Castlecliff Tramway Board of Wanganui.—*Board of Trade Journal.*

Manchester.—June 27th. Two water-tube boilers with superheaters, coal chutes, ash conveyor and fuel economisers, for the Corporation Electricity Department. See "Official Notices" June 9th.

Oldham.—One 1,200-KW. mixed-pressure steam turbine coupled to two D.C. generators in tandem, with barometric condenser, pumps, &c., for the Corporation. See "Official Notices" May 26th.

Rochdale.—June 21st. Construction of about two miles of permanent way of tramway, for the T.C. J. S. D. Moffet, Mellor Street, Rochdale (returnable deposit of £2 2s.).

Rotherham.—July 8th. Single vulcanised bitumen-covered cable (various sizes), smudge or pea nuts for a year from October 1st, and meters; Borough Electrical Engineer. Also stores and materials for the tramways department for a year. Tramways Manager.

Sheffield.—Tenders are to be invited for the supply of 1,000 tons of acid steel Sandberg tramrails.

Spain.—June 30th. Twenty-five years' electric light concession to Toro (province of Zamora). Tenders to El Señor Alcalde, Casa Consistorial, Toro.

Ten years' electric light concession for Villarrobledo. El Señor Alcalde, Casa Consistorial, Villarrobledo.

Swindon.—June 20th. Battery, traction booster, three-wire hand regulated booster, and switchgear for the Corporation electricity works. See "Official Notices" June 2nd.

CLOSED.

Bacup.—The E.C. has accepted the tender of Messrs. Ferranti, Ltd., of Hollinwood, for two transformers; that of the General Electric Co., Ltd., for meters; and that of the B.T.-H. Co. for switchgear.

Barrow-in-Furness.—The T.C. has accepted the following tenders in connection with the tramway extension to Biggar Bank :—

Edgar Allen & Co., Ltd., Sheffield.—Points and crossings, £379.
Barrow Hematite Steel Co., Ltd.—Rails, £6 15s. per ton, and fishplates, £2 extra per ton.

Belgium.—Ten concerns—six German, three Belgian and one French—submitted tenders last week to the municipal authorities of Brussels for the supply of electric cables required in connection with the electric lighting undertaking in the Belgian capital, the lowest (£3,077) being that of the Land und See Kabelwerk Gesellschaft, of Nippes, Cologne.

Bootle.—The T.C. has accepted the tender of the British Insulated and Helsby Cables, Ltd., at £566, for the renewal and erection of tramway trolley-wires in Stanley Road and Rimrose Street.

Bristol.—The City Council has accepted the following tenders for annual supplies :—

Wm. Geipel & Co.—Arc lamp carbons for open-type lamps, £346.
Sloan Electrical Co., Ltd.—Arc lamp carbons for flame-type lamps, £371.
Sykes & Sugden, Ltd.—Joint boxes, £190.
British Westinghouse Co., Ltd.—Electricity meters (watt-hour type for alternating current), £384.

Burnley.—The E.C. has accepted the tender of Messrs. Ferranti, Ltd., for the supply of the switchgear required for the new generating plant.

Canterbury.—The T.C. has accepted the tender of Messrs. E. J. Philpot & Son, of Canterbury, for wiring the public buildings for electrical illuminations for the Coronation and Cricket Week, at £50.

Cheltenham.—The T.C. has accepted the following tenders :—

British Thomson-Houston Co., Ltd.—Meters for a year.
W. Geipel & Co.—Open-type arc lamp carbons.
Ship Carbons, Ltd.—Flame carbons.

Dewsbury.—The T.C. has accepted the tender of Messrs. John Ake & Co., of Chickenley Wood, for 4,000 tons of coal for the electricity works.

France.—The French Post and Telegraph authorities in Paris have just given out contracts as follows :—La Compagnie Française du Bi-metal, of Paris, 100 tons of bi-metallic wire 2 mm. dia., and 50 tons ditto, 3 mm. dia.; and the Société d'Electro-Metallurgique de Dives, 100 tons ditto, 2 mm. dia.

Glasgow.—The T.C.'s Committee on Tramways, Works and Stores has recommended for acceptance the following :—

Clevis balls.—British Insulated and Helsby Cables, Ltd.
Double-ended insulators.—Estler Bros.; W. C. Yuille & Co.
V. mica rings for commutator.—George Schultz & Co.; Micanite and Insulators Co., Ltd.
Amber mica.—British Mica Co.
Ordinary mica.—Micanite and Insulators Co., Ltd.
Vulcanised cable.—R. R. Todd.

Kendal.—The T.C. has accepted the tender of the Yorkshire Boiler Co., Ltd., for a boiler for the electricity works, at £323.

Margate.—Messrs. Siemens Bros. Dynamo Works, Ltd., of Dalston, have obtained the contract for the supply of tantalum and "Onewatt" lamps, together with special electric light fittings, for the Fort Pavilion, Margate. For this magnificent new concert hall, the fittings have been specially designed in order to obtain the most artistic illuminating effect. In the centre of the main hall, there will be four cut crystal glass electroliers, each having six 9-in. projecting arms, and there will be ten 50-C.P. lamps in each; also four similar cut crystal glass electroliers, in which eight 50-C.P. tantalum lamps are installed. Under the balconies there will be 14 holophane bowl fittings, each having three projecting arms; in the central bowl a 200-C.P. "Onewatt" lamp will be installed, and 50-C.P. tantalum lamps in the holophane reflectors on each of the projecting arms. Under and over the gallery there will also be four holophane bowl fittings, similar to the above, but without projecting arms, and 200-C.P. "Onewatt" lamps will be installed. On the stage ceiling there will be 10 holophane bowl fittings, suitable for taking one 200-C.P. "Onewatt" lamp. Holophane fittings will be supplied for the colonade and entrance halls, and ornamental brackets with etched shades will be used for the front of the gallery. In the outside entrance hall, torch fittings and flambeaux will be used, whilst for subways and outside steps, cast-iron watertight fittings will be used. For external lighting, there will also be 40 cast-iron standards, approximately 8 ft. high, suitable for taking 100-C.P. "Onewatt" lamps. The footlights will be 30 ft. long, constructed with sheet-iron reflectors, enamelled white inside and black outside. There will also be a quantity of holophane shades and accessories for use in pendants, &c. The value of the fittings for this job will be £400, and as already mentioned in these pages, the total cost, including contracting, will be £730. The contracting work is placed in the hands of Messrs. Kingston & Co., of Northdown Road, Margate.

Northampton.—The T.C. has placed an order with Messrs. Dick, Kerr & Co., Ltd., for the supply of two new tramcars, with interpole traction motors, at £555 each.

Plymouth.—Messrs. W. G. Heath & Co., Plymouth, have secured the contract for Coronation electrical illuminations (2,000 lights) at the Plymouth Hoe bandstand and Smeaton Tower.

Salford.—The T.C. has accepted the following tenders :—

Hadfield's Steel Foundry Co., Ltd.—Special trackwork, £2,804.
Berry Transformer Co., Ltd.—Two transformers, at £89 10s. each.
Glover & Co., Ltd.—Annual supply of single insulated cable, twin workshop flexible cable, rubber cable, and bare rubber-stranded wire cable, approximate value £2,000.

A sample order for multiple-core cable has been given to Aubert Grenier & Co., Ltd.

South Shields.—The T.C. has placed an order with the British Westinghouse Electric and Manufacturing Co., Ltd., for one 1,500-KW. high-pressure steam turbine, coupled to one 1,100-KW. single-phase A.C. generator and one 100-KW. D.C. generator in tandem, complete with condenser, air pump and switch panels.

St. Helens.—The T.C. has accepted the tender of Messrs. Dick, Kerr & Co., Ltd., for a 2,000-KW. turbo-generator; and that of Messrs. Mirrlees Watson & Co., Ltd., for condensing plant.

Stockport.—The T.C. has accepted the tender of Messrs. W. A. Shaw & Co., Stockport, for wiring and renewing lamps at the baths.

Tunbridge Wells.—The T.C. has accepted the tender of Messrs. Jas. Keith & Blackman Co., Ltd., for an electric fan and air-duct work for ventilating the Town Hall, at £75.

Walsall.—The T.C. has accepted the following tenders :

British Westinghouse Co., Ltd.—High-tension switchgear for generating station.
Johnson & Phillips, Ltd.—Transformer for Bloxwich sub-station, and a design for illuminating the Council House for the Coronation.
W. Kendrich & Sons.—Erection of Bloxwich electrical sub-station.

Wigan.—In connection with the Coronation illuminations, the T.C. has accepted the tender of the General Electric Co., Ltd., for 1,500 yards of Pixielite, 2,250 lamps, 125 gelatine lanterns, and the necessary globes, &c., at £190.

The Council has further accepted the tender of Messrs. W. T. Glover & Co., Ltd., at £282, for cable, the other tenders being :—

British Insulated and Helsby Cables, Ltd.	£290
Callender's Cable and Construction Co., Ltd.	302
Johnson & Phillips	288

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

THE following orders are issued :—

Commanding Officer—COL. H. M. LEAF.

Monday, June 19th.—"A" Company. No parades.
Tuesday, June 20th.—"B" Company. No parades.
Wednesday, June 21st.—Detachments for the "Coronation and Royal Progress" will parade at headquarters for ceremonial drill at 7 p.m. Dress: Blue clothing-drill order with water-bottle and haversack. Special orders will be sent to each concerned.
Thursday, June 22nd.—"C" Company. No parades.
Friday, June 23rd.—"D" Company. No parades.
Saturday, June 24th.—No parades.

NOTE :—Headquarters will be closed during Coronation Week for all purposes except Coronation duty.

(Signed) J. H. S. PHILLIPS, Major L.E.E.

Electrical Contractors' Association Dinner.—The annual dinner of this Association takes place on Monday, July 3rd, at Frascati's Restaurant, under the chairmanship of the president, Mr. G. Harland Bowden. Tickets may be obtained for 10s. 6d. (exclusive) from Mr. L. G. Tate, the hon. secretary, 20, Bucklersbury, E.C.

Coronation Celebrations and Fire Prevention.—The British Fire Prevention Committee has issued a number of fire precautions for June 22nd, 23rd and 29th. Section C contains the following references to illuminations :—

1. Illumination devices must be fixed firmly with metal fastenings, *i.e.*, not with string or cord, and on no account placed on window ledges, balcony rails or the like overlooking public thoroughfares without being properly secured.

2. Curtains, hangings, &c., should be removed from around windows where open lights are to be used, and away from temporary wiring, fuse boxes, &c.

3. Buckets of water should be provided, also boxes of dry sand, where electrical illuminations are employed.

NOTES.

Coronation Holidays.—We would remind our readers and supporters generally of our altered arrangements announced on page 921 of our last issue, consequent upon the appearance of the ELECTRICAL REVIEW on Wednesday next instead of Friday.

We also desire to state that though our issue of the following week will be published on Friday (June 30th) as usual, the Royal Procession through the City will render it necessary for our offices on Ludgate Hill to be closed on Thursday, June 29th. We shall therefore be compelled to go to press with that issue a day earlier than usual, and we shall be glad if our correspondents will send their news and contributions at the earliest possible moment. Our Advertisement Department, in a special notice appearing on another page, asks for new copy and alterations to existing displayed advertisements by the morning of Saturday, June 24th, while official notices and small prepaid advertisements will be received up to 9.30 a.m. on Wednesday, 28th inst.

Disclaimer by "J. S."—We have pleasure in publishing the following letter received at the moment of going to press:—

"A postcard signed 'J. S.,' recommending the recipient to read some article in a periodical has been widely circulated; and those of my professional friends I have met since have asked me about it. May I use your journal to tell those I have not met that I am not the 'J. S.' who wrote the postcard? I never recommended anybody to read anything.

"J. SWINBURNE.

"82, Victoria Street, London, S.W.
"*June 15th*, 1911."

Metal-Filament Lamp Patents.—We have received the following copies of correspondence regarding lamp patents for publication:—

"1, Copthall Buildings, E.C.,
London, *June 9th*, 1911.

"The Corona Lamp Works,
51, Standen Road,
Southfields, S.W.

"Gentlemen,—We have been instructed by our clients, the Osram Lamp Co., Ltd., to communicate with you with reference to the infringement you have committed of their Letters Patent Nos. 23,899 of 1904 and 8,563 of 1907, by the manufacture and sale of lamps to Messrs. Galsworthy, Ltd., which lamps are, we understand, known as 'Mascot' lamps.

"We must ask you to give an undertaking forthwith to cease the infringement, and to deliver up to our clients any infringing lamps you have in stock, and also to give us full information as to the number and power of the infringing lamps sold by you, in order that we may estimate the amount of damage you have caused our clients.

"We shall be much obliged if you will give this matter your immediate attention.—We are, Gentlemen,

"Your obedient servants.
"(Signed) BRISTOWS, COOKE & CARPMAEL."

"2, Walbrook. London, E.C.
June 12th, 1911.

"Messrs. Bristows, Cooke & Carpmael,
1, Copthall Buildings, E.C.

"Dear Sirs.—Our clients, the Corona Lamp Works Co., have handed us your letter to them of the 8th inst., and instruct us to say that they are at a loss to understand why your clients, the Osram Co., should make the allegation that their patents have been infringed by our clients, as there is not the slightest ground for it, and our clients can only come to the conclusion that it has been made without proper inquiry, and they point out that the way in which their lamps are manufactured is by an altogether different method, marking a great advance in the manufacture of metallic-filament lamps, and differing altogether from the patents of your clients of 1904 and 1907, mentioned in your letter.

"Our clients learn that you have written to their selling agents making similar allegations, and demanding undertakings not to sell our clients' lamps, and we are to inform you that our clients are prepared to indemnify their customers in respect of any proceedings the 'Osram' Co. choose to bring against them in consequence of their selling the 'Corona' or 'Mascot' lamps, and we are to say that our clients will hold your clients liable for any loss or damage they may sustain owing to your clients' interference with their agents or customers.

"Our clients desire us to further state that they will meet and defend any action that your clients think fit to bring against them, and that we are to accept service on their behalf.—Yours faithfully,

"(Signed) H. C. MORRIS & Co."

Prize Competitions.—Two prize competitions are open under the decree of the Italian Minister of Agriculture, Industry and Commerce, to close on September 30th, 1911. The first is for a prize of 10,000 lire, for a theoretical and experimental investigation of the means of earthing industrial electrical installations, with particular reference to (*a*) the phenomena which are produced when any point of an electric circuit makes earth; (*b*) the influence of the nature and composition of the soil on these phenomena; (*c*) the effect of type of current and the pressure on the same phenomena; (*d*) the protective value of earthing, whether permanent or occasioned by pressure surges; (*e*) the means of maintaining and testing earths. The other competition is for a prize of 8,000 lire, for an apparatus to cut out of circuit an electric line at high pressure on the breakage of a conductor. This apparatus must be suitable for installation in stations or sub-stations, it must not necessitate any modification or material addition to installations, and must not lead to interruptions in supply.

Legal.—NATIONAL TELEPHONE CO., LTD. *v.* H.M. POSTMASTER-GENERAL.—In the Court of Appeal on Wednesday, this case began, hearing upon the cross appeal of the Crown and the company from a judgment of the Railway and Canal Commission.

HARTLEPOOL TRAMWAY CASE.—On Wednesday the action of the Hartlepool Electric Tramways Co., Ltd., and Sellon and Ashby *v.* the Mayor and Corporation of West Hartlepool was heard before Mr. Justice Bray in the King's Bench Division. His Lordship said he would take time to consider his judgment.

Electrical Fatalities.—Last week an inquest was held at Sherburn Hill into the death of John McPherson, aged 19, who had operated an electric conveyor at Lumley Third Pit. From a very full report in the *Durham Chronicle* we gather the following notes. Deceased had done the same work for six years. The medical evidence said that the healthy condition of the organs, and the markedly fluid condition of the blood, combined with the burns on the forearms and on the inner sides of the great toes, strongly pointed to death caused by electricity. The deputy overman (G. Coulson) said that the deceased seemed to understand his work. He saw him alive at his motor at 10 a.m. on May 13th, and went to the other end of the conveyor and received word to tighten it up. On his return to the motor end, when he got to the switchbox he found McPherson lying on his left breast, with his face to the ground. There was some water between the sleepers and the rail, and his face was in it. Coulson tried artificial respiration for an hour and a half. The switchboard was only 20 yards from the motor, and all that occurred only occupied three minutes. It was the electrician's duty to see that the machine was in order. The same morning Coulson and deceased had slight shocks from the motor, and the matter was reported to the foreoverman, who had the machine stopped, and sent for the electrician. Deceased had never complained before of having received any shock. Another man had said that he had received a slight shock from a fan. There was no occasion for McPherson to touch the motor, and he did not think he was in the habit of touching it. He had only heard humming twice or thrice in a month. There was probably 2 or 3 in. of water between the sleepers, and generally the boy, when working there, stood on the plates. T. W. Lawson, apprentice electrician, who had been three years in the pit, said that when he received a message that the electrician was wanted down the pit, he could not find the chief, so he went himself and met deceased, who said that the motor was "a bit tickley." He shut off the current and found that the little strands of one of the leads had been catching the side of the framework of the motor, and had been burnt away. He tightened the strands up, and put some rubber tape and black tape around them: he then switched on the current and everything was right. He got no shock. The machine frame had never been alive before when it was running. The leads were fixed to the cables; the risk would be obviated if the leads were fitted into the holes of the motor and without having to pare off the strands.

R. Dobbing, the chief electrician, said that what the last witness had done he considered quite right and proper. There was a previous case of a shock from a cutter, but this was the first time he had had a report of shock from a motor frame. He did not think Coulson received an electric shock. He had been at the colliery three years. He examined the motor the previous night and found everything right.

Mr. H. J. Fisher, engineer to the Lambton Collieries Co., said that he made an examination of the machinery after the accident to see if it was properly earthed, and he also examined the continuity of the earth to bank. Tests were taken of that continuity, and were entirely satisfactory. That proved that it was impossible to get a shock from the framework of the motor. He knew of the repair done to the motor, and he thought that confirmed the impossibility of getting a shock. He thought there must have been an intermittent break in the earth. The humming of the machine was intermittent, and this was proved by its not humming one day, but on another after the accident. The earth plates at bank had been tested, and found satisfactory. The earthing of a portable machine like that motor was not compulsory. The boy might have inserted his fingers in the terminal box, and thus got a shock. The motor was humming when he made the test. He did not regard the terminal box as an ideal method of connection with the motor, but it had been in operation there and elsewhere for several years without an accident. He did not think it necessary to alter it, but they were doing away with the terminal box and putting in a plug box and automatic switch. There was a great deal of vibration with the motor, which might easily slacken the nut in the motor frame and thus weaken the connection. The boy would only have to slide the terminal cover to one side in order to put his fingers in. He had never heard of any complaints of shock previously to that accident.

A driver, in evidence, said that deceased asked him to tell the men to tighten the chain, and when he left deceased he had a hammer in his hand, but not his lamp. The tub was not touching the conveyor. When he left deceased, he was knocking in a prop with a

mell. Witness added that he touched the conveyor with his hand and got a shock just like pins and needles.

George Watkins said it was impossible for Heron to have got a shock without his having also done so, and he certainly did not receive any shock.

James Smith, miner, said that he had received shocks when filling the pans, and left off work. He saw the electricity "flying."

The jury came to the conclusion that McPherson was killed by an electric shock accidentally received, and recommended that experienced men only be employed to attend to electrical machinery. They attached no blame to the management.

An Edinburgh paper states that Henry Johnston, miner, 21, has been killed at Auchengeich Colliery, belonging to Messrs. James Nimmo & Co., Ltd. Johnston, it appears, had accidentally come in contact with a live electric cable in the underground workings, and was instantly killed.

A Testimonial to Electric Cooking.—The old proverb about the proof of the pudding has no better application than to the merits of electrical cooking, and the unsolicited testimonial given below will be of interest to all who are concerned in this question :—

"Messrs. The Berry Construction Co., Ltd.,
29A, Charing Cross Road, W.C.

"Gentlemen,—As we have now had the 'Tricity' cooking apparatus in use for about six weeks, I feel I should like to contribute my opinion on its utility and saving in the culinary department of our household. The first thing that I should like to mention is the convenience in using these cookers, and the thorough cleanliness of the whole system. Secondly, the amount of electricity consumed, up to the present, I feel sure will quite hold a favourable comparison against 'gas' or 'coal.' Again, when one has once tasted joints, poultry, &c., cooked by the 'Tricity' cooker, they will never want to return to *gas* or *coal* cooking, as every joint is now most tender, and has the appearance of being larger when cooked by electricity, instead of being drawn and shrivelled up, as it is when cooked by the gas or coal. Lastly, when my wife and self attended one of your demonstrations in February, we were told that a saving of at least 10 per cent. of the joint's weight resulted from the use of the 'Tricity' cookers. This assertion I at once thought I should like to find out myself, and I now enclose a list of joints, with weights of each before and after cooking by gas, coal and electricity, and leave you free to make what use you like of this correct report.—I am, Gentlemen, yours very truly,

"(Signed) A. HAYNES.

Date, 1911.	Joint.	Weight before cooked.	Weight when cooked.	Type of oven.	Loss.	Loss per cent.
		lb. oz.	lb. oz.		lb. oz.	
March 23	Ribs of beef	5 7	3 12	Coal	1 11	31
,, 26	Leg of mutton ..	8 8	5 13	,,	2 11	31·7
,, 29	Shoulder of mutton	6 13	5 1	,,	1 12	25·7
April 2	Leg of mutton ..	8 4	6 0	Gas	2 4	28·1
,, 9	,, ,, ..	9 0	7 12	"Tricity"	1 4	13·9
,, 15	Shoulder of mutton	4 12	4 2	"Tricity"	0 10	13·1
,, 16	Ribs of beef	9 1	7 6	"Tricity"	1 11	18·6
,, 23	Leg of mutton ..	9 1	7 10	"Tricity"	1 7	15·8
,, *30	Shoulder of mutton	5 10	5 0	"Tricity"	0 10	11·1

"N.B.—You will note that the last item (*) shows the best results—*i.e.*, the least shrinkage. I think this is explained by the fact that the use of the 'Tricity' oven is now perfectly understood.

"(Signed) A. HAYNES,
"25, Woodfield Road, Ealing, W."

Wages of Electricians in Queensland.—An Australian paper says: "By a determination which took effect from March 13th, a Wages Board appointed for the purpose has amended the terms under which men may be engaged to do electrical engineering work throughout the whole of Queensland. The minimum wages for workmen paid by the day range from 11s. to 8s. 6d. for work done in the Southern Division, with 1s. 6d. additional for work done in the Central Division, and 3s. additional for work done in the Northern Division. Electricians in charge of installations, Class 1, are to be paid £3 15s., £4 5s. and £4 15s. for the Southern, Central and Northern Divisions respectively, while the corresponding rates for Class 2 are £3, £3 10s. and £4. Apprentices engaged under written indentures are to be paid 5s., 10s., 15s., 20s. and 30s. per week for the first, second, third, fourth and fifth years of their apprenticeship. Forty-eight hours are to constitute the usual week's work, between 7 a.m. and 12 noon on Saturday, and between 7 a.m. and 6 p.m. on the five other working days."

Electrical Vehicles in the German Postal Service.—We learn from Berlin that the German Postal authorities are about to extend considerably the use of electrical motor vehicles in connection with the collection and delivery of the mails. For the collection of the letters from the street letter boxes, an electric three-wheel carrier tricycle has been adopted, and the first of these have been put to work in connection with one of the Post Offices in Charlottenberg, and one in North Berlin. The machines, which have been built by the Berliner Elektromobilfabrik, of Berlin, are capable of running a distance of about 44 miles on one charge of the battery, at speeds ranging from 10 to 12 miles per hour, and of carrying a load of 5 cwt. The experiments which have so far been made show that a considerable saving in the time occupied in collecting the mails is effected by means of the new machines.

Appointment Vacant.—Fourth assistant engineer for the Hammersmith B.C. electricity department (£130). See our advertisement pages in this issue.

Royal Institution.—On Thursday last week, Mr. T. Thorne Baker delivered a lecture on "Practical Progress in Wireless Telegraphy."

Electrical Advisory Departments in Bavaria.—An advisory department of electrical engineers has for some time past been associated with the water-power section of the Bavarian Government Superior Works Department for the purposes of examining schemes submitted for approval for the erection of central stations, particularly in regard to the utilisation of State waterfalls, reporting on the contracts and conditions of supply, and advising the districts and communes on all questions appertaining to the subject. At first an attempt was made to get the engineers also to examine schemes for small electricity works of only local importance, and to report on installations for individual consumers, but this had to be abandoned as imposing too great a burden, and as exceeding the limits of State control. Arrangements were, therefore, made for this work to be done by certain associations, together with reliable private firms, requisitioned as advisers. In addition, the Polytechnic Association, of Munich, recently established an advisory department for electrical questions; the Bavarian Agricultural Council intends to start a similar organisation, which will be mainly devoted to giving advice to individual agriculturists in connection with the employment of electric power in agricultural work; and the Christian Peasants' Association is also credited with a similar scheme. A further step has been taken by the Bavarian Government to protect the communes and inhabitants from any monopolistic efforts in the supply of motors, lamps, &c. It has, for instance, been made a regulation that the communes which wish for a supply of electric light shall first apply to the District Board. The Board will then invite tenders according to a specification prepared by the State Ministry; the offers are communicated to an approved expert for examination, and the contracts are awarded by the commune with the co-operation of the expert. The successful firm has then to negotiate with individual consumers in regard to their orders, the prices being determined by the unit prices in the specification.

A Centrifugal Method of Producing Reinforced Concrete Poles.—The advantages of reinforced concrete poles as regards strength, appearance and length of life have enabled them to supersede wooden and iron masts in many modern Continental electric transmissions and electric lighting schemes. A description of an improved process for the standardised production of such poles appeared in the *E.T.Z.* for March 9th, from which we take the following particulars:—The poles are formed in long hollow two-part moulds arranged for continuous rotation at a high speed. The moulds or formers are of wood lined throughout with sheet metal. The skeleton of the pole, in the form of a system of steel rods wired together, is placed inside the mould and centred with a predetermined spacing from the walls of the mould—this spacing being effected by the use of small concrete distance pieces wired on to the steel structure. The steel structure itself is built up in automatic machines.

The rotation of the mould is brought about by fixing it inside a set of tubular holders provided with self-centring grips, like lathe chucks, and free to rotate on a set of friction wheels around the periphery. The driving belts run directly on the surface of the tubular holders. Various numbers of these holders are set in line according to the length of pole under construction.

The mould having been fixed in these chucks, the liquid concrete is fed into it. This concrete is usually made up of Portland cement and clean quartz sand in the proportion of 1 : 3, and a considerable amount of water is used, so as to give a thin mixture. Sometimes other materials are added in order to modify the colour to any desired extent.

When sufficient concrete has been run in, the mould is closed and is quickly brought up to the full speed of 500 or 1,000 R.P.M. No time must be lost in getting up to full speed, as it is important to allow the centrifugal force to bring the mixed solids to the outer periphery without any separation due to their unequal specific gravities.

Most of the water, however, separates out, owing to its lower specific gravity, and collects in the centre of the mould, where it serves the useful purpose of compressing the concrete against the steel rods and the outer periphery, thus ensuring the formation of a homogeneous and compact tubular mass.

The mould is kept running for from 10 to 15 minutes, and can then be removed from the revolving machine to make place for the next pole. The excess water is run out, and the whole structure remains at rest in the mould for one or two days to allow the concrete to set partially. The pole is then withdrawn from the mould and embedded in damp sand for three or four weeks to dry out completely.

The steel structure of the poles is calculated to withstand the maximum side pull to which the pole will be subjected, with a factor of safety of four or five without allowing for the considerable extra strength given by the concrete itself. Tests made by various authorities have shown great uniformity in regard to strength. The outsides of the poles are either smooth cylinders or 8 or 12-sided polygons, the central hollow being conveniently used for the lamp leads or feeder cables.

Parliamentary.—In the House of Commons on Tuesday the Lords' amendments to the Metropolitan Electric Supply Co. (Acton District) Bill were agreed to.

ELECTRICAL DRIVING OF A MODERN CALICO PRINTING WORKS.

Among the many manufacturers of finished cotton goods there are few, if any, in this country who can equal Messrs. Ferguson Bros., Ltd., who, for 86 years, have aimed at producing the finest and best qualities of dyed and printed linings, sateens, twills, longcloths, &c., for which they have a market, not only in this country and the colonies, but in all civilised parts of the world, in spite of the heavy tariffs imposed on British goods.

Messrs. Ferguson Bros. are the only firm in this country who carry out the manufacture of their goods from the raw cotton to the finished article in their mills at Holme Head, Carlisle.

Main Switchboard, Holme Head Works.

Up to last year all their printing was done for them by a neighbouring firm, but in 1909 the firm decided to have their own printing plant. These works were completed last year, and are the most up to date in the country.

The steam raising plant consists of two 28 ft. × 7 ft. 6 in. Lancashire boilers, economiser, boiler feed pump and a centrifugal pump. Over the boiler house is a 30,000-gallon tank which supplies the print works.

The centrifugal pump which is used for filling this tank is direct coupled to a 6-B.H.P. motor running at a speed of 1,200 R.P.M.; the motor is controlled by an automatic solenoid switch operated by a float.

The boiler feed pump, of the three-crank type, is coupled through spur gear to an 8-B.H.P. motor running at a speed of 600 R.P.M.; the economiser is belt-driven by a 4-B.H.P. motor running at 1,050 R.P.M.

As it is necessary to use steam in the process of calico printing, the question arose as to the best method of driving the printing and other machines. Mr. F. W. Chance (the chairman of the company) visited works

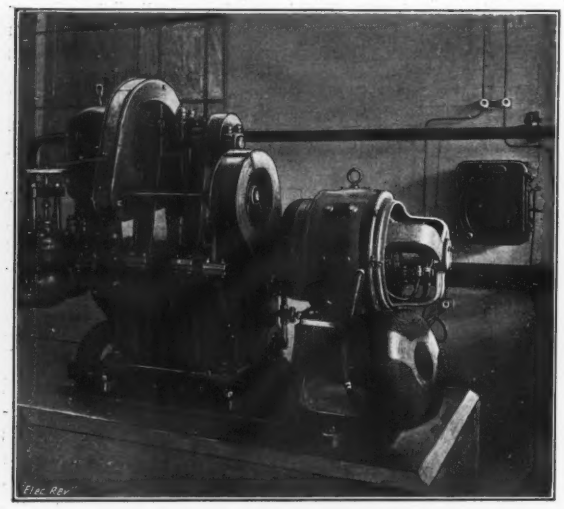
General View of Electrically Driven Calico Printing Machines, Holme Head Works.

The buildings consist of boiler house, white batch room, printing room, roller room, roller polishing room, colour shop, steaming room, and two washing and drying rooms,

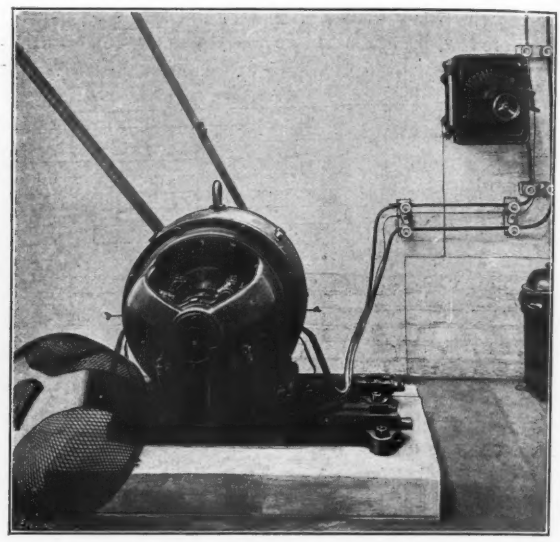
both in England and Scotland for the purpose of ascertaining whether individual engine or electric motor drive was the most satisfactory in regard to smooth running,

nicety of speed regulation and economy and the result of his investigations was in favour of electric drive.

In the printing room there are at present five calico printing machines made up of three three-colour, one four-colour, and one six-colour machines. The motors driving



MOTOR-DRIVEN BOILER FEED PUMP.



LINE SHAFT DRIVE.

the three-colour machines have an output of 32 B.H.P. running at a normal speed of 325 R.P.M., with a maximum of 780 R.P.M. on shunt control; these motors are coupled through double reduction gear on to the machine star wheels.

The six-colour machine is driven in the same way as the three-colour machines, the motor in this case being a 38-B.H.P. one running at a normal speed of 320 R.P.M., with a maximum of 900 R.P.M. on shunt control.

The four-colour machine is driven differently to the others, the motor in this case being coupled direct on to the star shaft through worm gear, which is completely enclosed, and runs in oil. The advantage of this type of gear is that there is no risk of backlash and consequent cutting of the rollers, and also the space occupied is appreciably less than with spur gear.

The motor driving this machine is of 32 B.H.P. running normally at 400 R.P.M.; maximum speed on shunt control, 1,200 R.P.M., and minimum, 250 R.P.M., on series control.

The controllers are of the drum type, in each case the spindles being geared to a cross shaft fitted with hand wheels at each end, for enabling the printers to control the motor speed from the front and back of the printing machine.

It being necessary to run the motors slowly for "pitching" the machines, each controller is provided with resistances for series as well as shunt control.

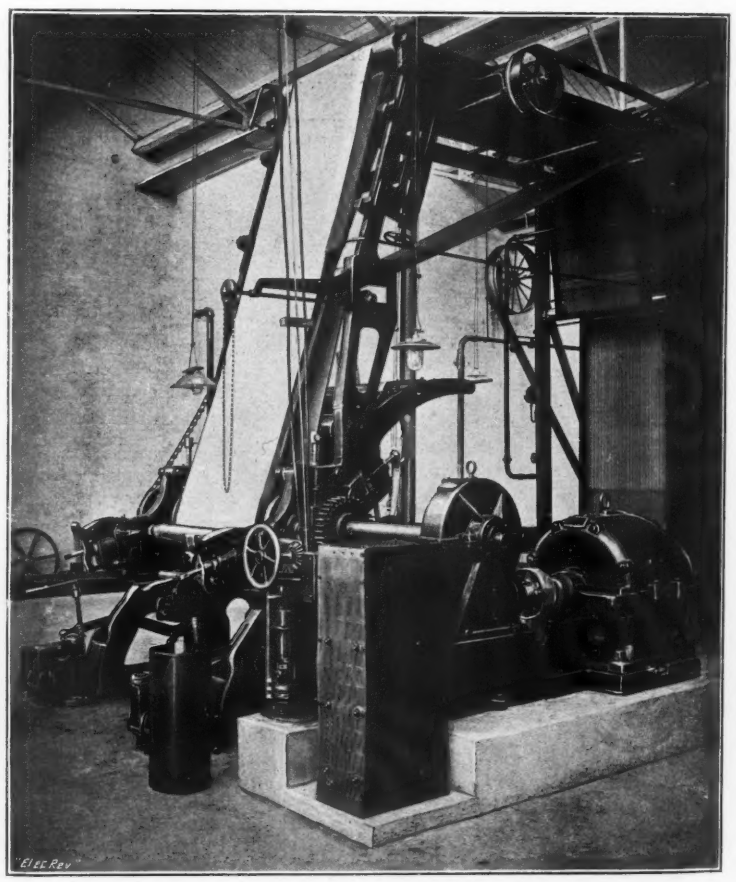
The controllers were manufactured by the Electric and Ordnance Accessories Co., Ltd.

The driers in which the cloth is dried after printing are placed immediately behind the printing machines.

The fans of the hot air drying apparatus, and the blanket washers of all the sets of drying plant, running at constant speed, are driven from an overhead line shaft which extends the whole length of the printing room. This shaft is belt-driven by a 35-B.H.P. motor running at a speed of 800 R.P.M.

The shaft in the printing room is extended through to the colour shop, and from it the stirrers for the larger sized colour pans are driven.

The cloth, after having been printed, is wound into folds on collapsible winches before being placed in the steaming cottage where it is steamed for the purpose of fixing the colours.



SIX-COLOUR PRINTING MACHINE WITH MOTOR AND WORM DRIVE.

The winches are driven by a $1\frac{3}{4}$-B.H.P. motor with worm gear reduction between the motor and winches.

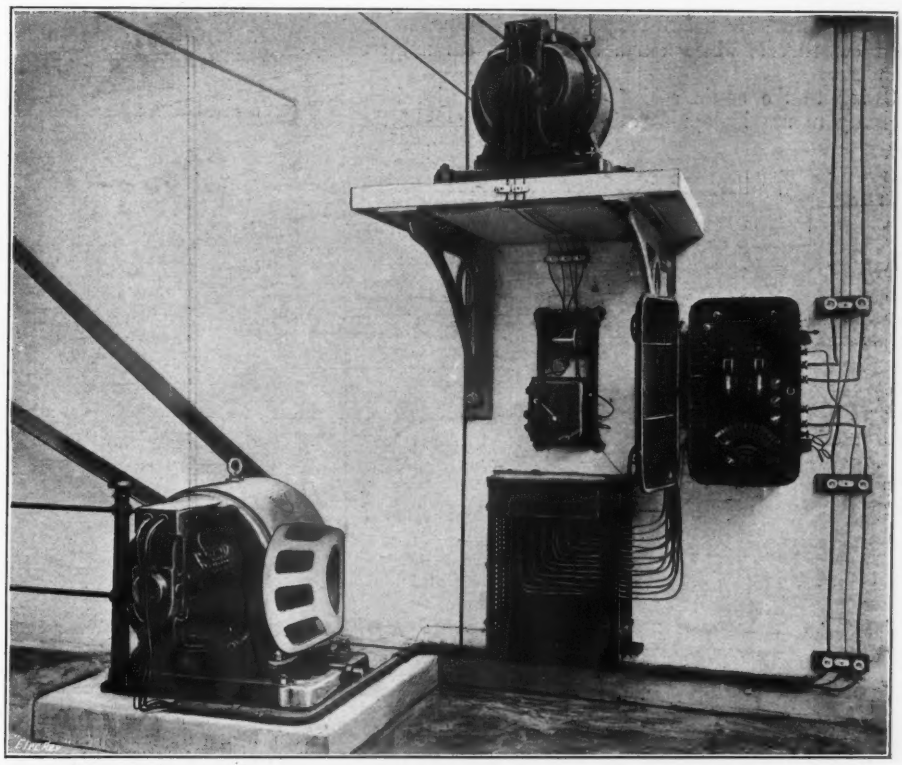
For the final process in the print works, the cloth is passed through an open soaping and chloring range, in which it is

thoroughly washed and the superfluous colour and size removed; afterwards it is dried on steam-heated copper cylinders arranged in tiers, and plaited down and taken to the finishing department in the mill to be finished. Two of these machines are in use, each being driven by two motors.

The drying cylinders on one of the machines are driven by an 18-B.H.P. motor coupled direct through spur gear and running at a normal speed of 260 R.P.M., with a maximum on shunt control of 730 R.P.M.

The motor driving the beaters in the washing and soaping compartments of the machines is coupled in a similar manner, and has an output of 10 B.H.P. running at a constant speed of 580 R.P.M.

The cylinders in the other machine are driven by a 25-B.H.P. totally-enclosed motor running at 330 R.P.M. normal speed, with a maximum of 500 R.P.M. on shunt control. The beaters are driven by a 15-B.H.P. motor running at a normal speed of 650 R.P.M. with a maximum of 1,350 on shunt control. Both these motors are connected to the machine by belts.



25-B.H.P. MOTOR DRIVING CYLINDERS OF OPEN CHLORING AND SOAPING MACHINE, WITH SPECIAL SWITCHGEAR; ALSO SMALL FAN MOTOR.

The controllers for these four motors were specially designed, and contain electrically operated main switches so interlocked with the starting and speed regulating rheostat switches as to make it impossible to start the motors too quickly, or insert any resistance in series with the fields unless all resistance has been cut out of the armature circuit, or *vice versâ*. The switch fronts are entirely enclosed in iron watertight cases, with only the regulating switch hand wheels projecting through packed glands on the fronts of the cases.

The controllers were manufactured by the Adams Manufacturing Co., Ltd., who also made several other switches in use at the works.

The ventilating fans, of which there are six ranging from 24-in. diameter to 52-in. diameter, are of the "Sirocco" type manufactured by Messrs. Davidson, of Belfast, and are all motor driven.

The whole of the machinery and motors were (with the exception of two soap becks and a washing and drying machine) manufactured and erected by Messrs. Mather and Platt, Ltd., of Manchester, who were also responsible for the design of the buildings. The machines enumerated above were manufactured by Messrs. Edmeston & Sons, of Patricroft, and the motors for them by the Lancashire Dynamo and Motor Co., Ltd., of Manchester, who also built several of the motors driving the fans.

Separate cables are carried from the main switchboard to the motors driving each machine.

It being most essential that the works should be well lighted, special attention was given to this and the switching arrangements.

Each printing machine is provided with four hanging lamps, two throwing the light direct on to the cloth in front,

FIG. 1.—NEW BREWING HOUSE.

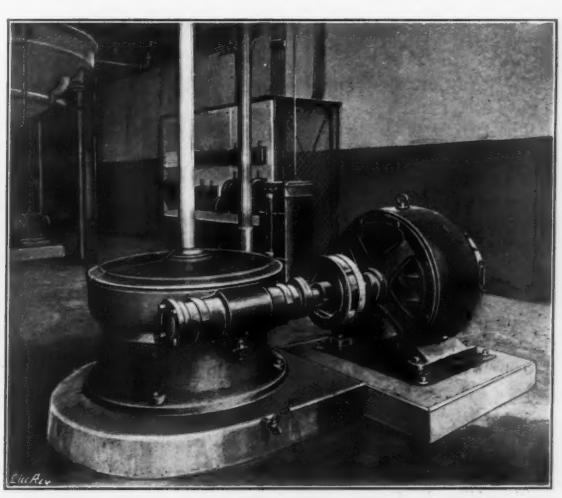


FIG. 2.—ELECTRICALLY-DRIVEN STIRRER FOR MASH TUN.

HANOVER MUNICIPAL BREWERY (see page 966).

and one on either side ; a portable lamp is also provided for use at the back of the machine.

The lamps for each machine are controlled by a separate switch. The general lighting of the printing room is carried out by groups of four and two 50-c.p. metal lamps contained in fume-proof fittings fitted with packed glands for the leading-in wires ; the same class of fitting is adopted in the other departments where steam or acetic acid fumes are prevalent.

Owing to the acetic acid fumes in the works, it is necessary to use high-grade cables, and these are of the

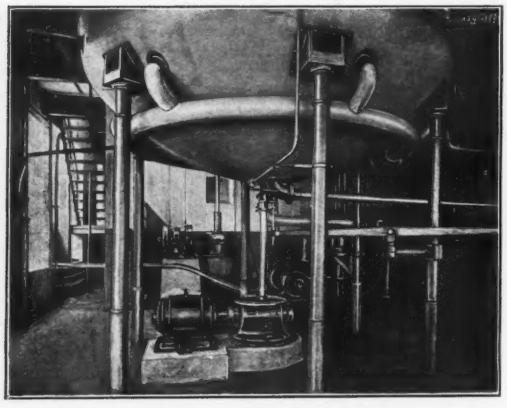


Fig. 3.—Electrical Drive; Wort Kettle.

5,000-megohm grade, manufactured by Messrs. Henley's Telegraph Works Co., Ltd., and are carried on split insulators, no casings or tubing being used in any part of the installation.

The main switchboard contains the d.p. circuit-breakers and ammeters controlling each of the machines and a panel controlling the reducer set ; there is also provided a spare panel for extensions. The switchboard was manufactured and erected by Messrs. Cox-Walkers, Ltd., of Darlington, who also carried out the wiring installation.

The supply is obtained from the Carlisle Corporation Electricity Works—special mains, in duplicate, being run from the station to Messrs. Ferguson Bros.' Works.

The supply being at 500 volts, it was necessary to reduce the pressure to 100 volts for the lighting circuit.

The set installed is a reducer type motor-generator manufactured by the Lancashire Dynamo and Motor Co., Ltd.

The two machines consist of a 400-volt shunt-wound protected type motor coupled to a 100-volt compound-wound dynamo coupled back to back on a combination bedplate.

The set runs at a speed of 570 r.p.m., the two machines being run in series across the 500-volt circuit.

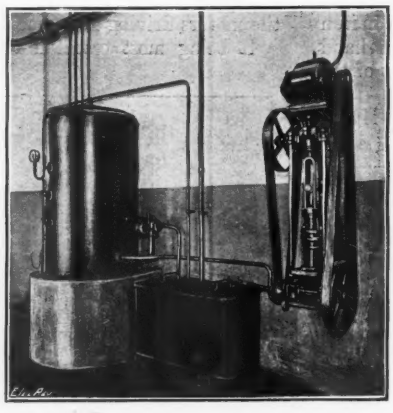


Fig. 5.—Motor-Driven Pressure Pump.

In conclusion, we are indebted to Mr. F. R. Batty (Messrs. Ferguson Bros.', consulting electrical engineer), for the information contained in this article.

Wakefield Electric Lighting.—The L.G.B. has sanctioned in respect of the electricity undertaking a loan of £5,000 repayable in 17 years.

A new scale of charges for electrical energy for power consumers is to come into operation on September 1st next.

ELECTRICITY IN A GERMAN BREWERY.

[by our berlin correspondent.]

The Municipal Brewery of Hanover recently reorganised its service, adopting electrical operation in its various departments.

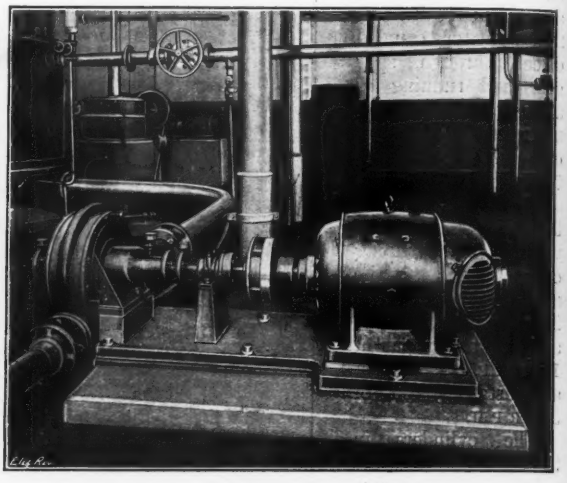


Fig. 4.—Wort Pump and Motor.

The new brewing house (fig. 1) is situated on the ground-floor, and comprises, in a large hall 22·5 metres in length, 15·5 metres in width, and 12 metres in clear height, six copper kettles, of which only four are visible in the view. The mash tun and mash kettle are installed along the front side of the large hall, the two wort kettles being midway between them. In the background are seen the clearing pails on a somewhat higher level. To the right and left of the staircase are arranged the clearing taps and quite in the background behind the clearing pails are hand-wheels for actuating oil starters.

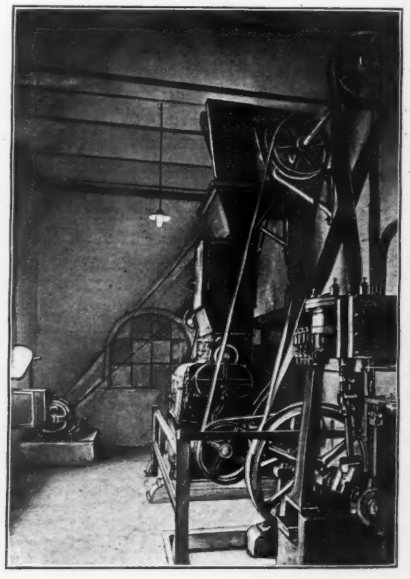
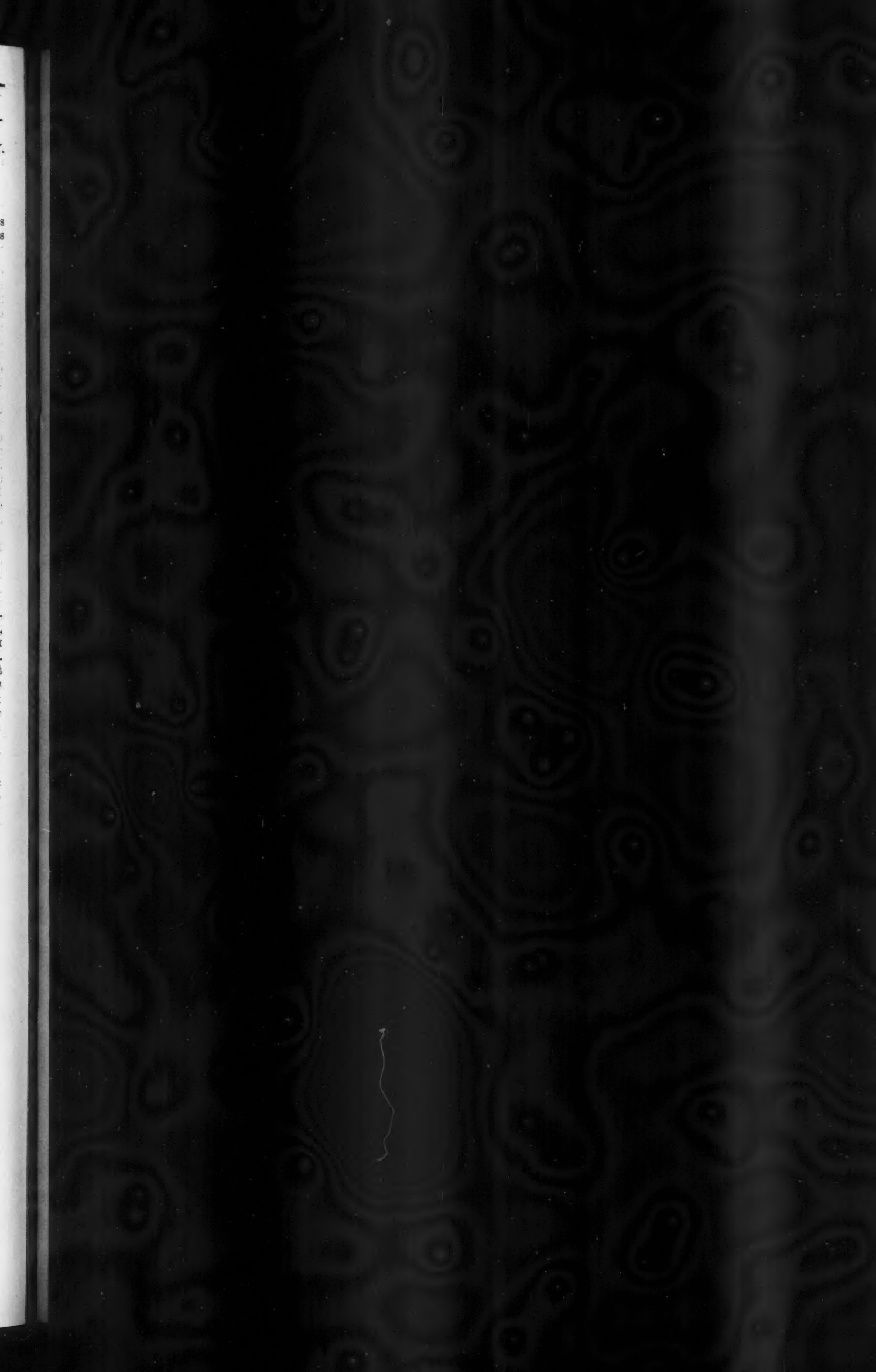


Fig. 6.—Grinding Mill and Compressor with Motor Drive.

The wort is conveyed back from the clearing plant by means of pumps direct coupled to motors, and installed below the clearing pails. Below the latter is a motor driving the malt husk worm, thus allowing the malt husks to be readily discharged.



Two arc lamps serve to light the brewing hall, incandescent lamps being used for emergency lighting.

This brewing installation allows 5 tons of mash chippings to be dealt with every four hours. Each kettle is of 36,600—45,300 litres in capacity.

In fig. 2 is shown the stirring device for the mash tuns, the vertical shaft of which is driven by worm gear directly connected by a flexible coupling to the motor. Behind the motor is seen the vertical controller for regulating the speed, which is operated from a switch pillar on the ground floor. In the background is also seen the motor for driving a wort kettle, the stirring device of which is driven in the same way. This motor, which has no speed regulator, is controlled by an oil starter suspended from the ceiling.

In fig. 3 is shown the drive of one of the wort kettles, which has a double bottom insulated by material impervious to heat. In the background is seen, to the right, the direct-coupled wort pump motor, and on the top the motor driving a clearing pail.

In fig. 4 the wort pump is shown separately with the driving motor, the pump drawing in the wort from the hop basket (to the left). This wort-pump motor has speed regulation, allowing the wort to be conveyed at variable intervals up to the cooling floor, at a level about 18 m. higher. At the average speed the motor takes about 25 minutes to pump 350 hectolitres up to the cooling floor. In the background is seen on a higher level the drive of the second clearing pail.

Fig. 5 illustrates the belt drive of the pressure water pump, beside which the pressure water kettle is located. A special pump supplies hot water to the whole of the brewing house.

In the loft are the mill for grinding chippings and the compressor for handling the malt. As seen in fig. 6, this machine is actuated through the intermediary of gearing connected by belt transmission to the motor.

The brewing-house plant above described was supplied by A. Ziemann, of Feuerbach-Stuttgart, the electrical machinery having been installed by the A.E.G., to the managers of which we are indebted for the above particulars.

THE B.E.T. REPORT.

On the whole the report and accounts of the British Electric Traction Co. can only be described as depressing reading, even after acknowledging the fact that the credit balance of the profit and loss account at £139,512, exhibits an improvement of £9,000 on the year 1909-10. Debenture interest, however, paid or accrued, disposes of over £93,000 of this sum, thus leaving a balance of £46,000, which, with the amount brought forward from 1910, viz., £14,067, make a disposable sum of £60,067, out of which £24,215 is to be paid to the preference shareholders, bringing up the payment of the full dividend on the preference shares to September 30th, 1908. £25,000 is appropriated to reserve, the residue of £10,831 being carried forward. The preference dividend is thus in arrear as from October 1st, 1908.

It was commonly reported some time ago that the accounts of this company would show considerable improvement on the strength of which the preference shares soared in blissful innocence or ignorance from 48s. 9d. to about 90s. Market movements are strange and wonderful to behold!

There is little information in the report that is of any practical use to the shareholder. Somewhat terse with an abundance of stereotyped forms of expression, it must have been received by the preference and ordinary shareholders with dissatisfaction. So far as the profit and loss account is concerned, the only redeeming feature is an increase on the previous year of some £10,000 on the dividend income; but this is negatived by a decline in the income from interest on debentures, and interest on consols, whilst the net profit on the working of the Barrow, Brighton, and Mumbles undertakings is also some £1,300 less than that of the preceding period; interest on loans and deposits is something like £2,000 short of that for 1910, and there is even a decline in the income from fees for services rendered, &c. There is an item of £1,675 net profit on sale or realisation of investments shown indented in the profit and loss account, which, as we shall see presently, has been applied to the reserve. The indication of the item in the manner shown, seems to be mere pedantry, when, for instance, the uncalled liability of £41,436 on investments is not similarly shown on the face of the balance-sheet, but appears towards the end of Schedule I in a group of printed matter.

There is an item in the balance-sheet for stocks of cars, equipments and general stores, which, less a reserve of £7,000, stands at £8,623. This item seems somewhat antique, and it is about time that it was dealt with in a satisfactory manner.

We have on previous occasions referred to the inordinately high total of the sums described as debts due to the B.E.T. by the subsidiary companies. Some effect has been given to the suggestion that we made previously that the indebtedness should be liquidated by the issue of fully-paid shares or debentures to the B.E.T., as during the year £199,949 has been satisfied, more or less, in this manner. Even after this large liquidation the indebtedness of the subsidiary companies to the B.E.T. is not much short of a quarter of a million, and this is after allowing £34,787 for reserve. No details are given of the nature of these sums described as debts nor the date when they were incurred. Some of them must be getting rather old. Possibly if there were independent management as between the B.E.T. and its subsidiaries, this state of indebtedness would not be continued. There is still a very large sum to write off expenditure on Acts of Parliament, viz., £23,789.

During the year £42,500 of the 5 per cent. perpetual debenture stock and second debenture stock of the company were purchased, and the stocks have consequently been correspondingly reduced by that sum. The operations culminated in a credit balance of £12,393, *i.e.*, the difference between the nominal value and the purchase price of the stocks redeemed. This sum, however, was depleted by a loss on the sale of consols of £6,318; but the sale of certain investments yielded a profit of £1,675, the resulting sum being an addition to the reserve of £7,749. The average price paid by the company for the redemption of its debenture stocks seems to be in the neighbourhood of 70 per cent. What about the original allottees of the debenture stocks? What have they lost in capital?

The reserve at March 31st, 1911, is £641,331, out of which only £70,000 has been contributed by profit and loss. The bulk of it has been accumulated by the premiums paid by possibly sorry shareholders, &c., on share and debenture issues.

The schedule IV of amounts set aside by associated companies for depreciation and other reserve funds, including balances of profit carried forward is, as it stands, so much waste paper, and it is distinctly on a par with the bald statement of units generated for three years by the Associated Electricity Supply Companies of the B.E.T. As it is at present prepared, the schedule is, of course, of no value whatever to the shareholders. The investments, including the expenditure of the undertakings at Barrow, Brighton and Shoreham, and Mumbles, less reserve, reach a total of £5,204,667, of which, during the year, £3,386,575 were revenue-earning with an average return of 3·96 per cent. Investments of £1,679,007 yielded no return during the year.

The report refers to the proposed reorganisation of the capital of the company dealing with the arrears of preference dividend. That such a course would have to come has been long evident to the man in the street, and little financial talent is required to formulate an equitable scheme.

Turin Exhibition.—At the Turin Exhibition a modern electric train is shown, drawn by a locomotive of the latest type adopted for the Giovi line. The locomotive has a weight of 60 tons, and is capable of developing a power of 200 H.P.; two of these locomotives are able to haul upon the difficult section from Pontedera to Busalla a train of 390 tons at a speed of 45 km. per hour. There are also six bogie coaches, of modern Italian build, a boiler-coach (employed for the heating of electric trains), and a van for the carriage of goods at high speed.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. E. J. JARVIS, of Torquay, has been appointed junior assistant electrical engineer at the Devonport Electricity Works.

The Leek U.D.C. has increased the salary of MR. W. E. CHILD, assistant engineer, from £100 to £110 per annum.

On the occasion of his marriage on June 7th to Miss A. Langridge, MR. JOHN MORRIS has been presented by the staff at the Lewes Electricity Works with a barometer.

On Friday evening, June 2nd, a large number of the employés at L.C.C. Greenwich generating station gathered at the Trafalgar Hotel, Greenwich, to present MR. PILCHER (late charge engineer of the Greenwich generating station) with a silver inkstand on the occasion of his leaving the above station. Regret was expressed that Mr. Pilcher was leaving his friends after so many years amongst them, and he was enthusiastically wished health, happiness and prosperity, in the future.

MR. H. LISTER, senior engineer-in-charge at the Middlesbrough Corporation Electricity Works, has been appointed charge engineer at the Newcastle and District Electric Lighting Co., Ltd., electricity works.

The Hackney Electricity Committee recommends that the salary of the sales engineer (MR. C. LILL) be increased to £150 per annum, plus a commission of 2½ per cent. per annum in respect of all sales in excess of £4,000.

MR. JAMES A. WISHART, formerly mains superintendent at the Leith Corporatian Electricity Department, has been appointed burgh electrical engineer for the Burgh of Motherwell, at a commencing salary of £250 per annum. Prior to Mr. Wishart's recent appointment at Motherwell, he was engaged there as mains superintendent.

MR. S. C. SHEPPARD has been appointed to the position of mechanician at the Croydon Corporation Electricity Works.

MR. EGERTON J. WARD, A.M.I.E.E., was presented last week with an engraved silver cigarette case by the staff of the Eccles Corporation Electricity Department, on his leaving to take up an appointment with the Para Electric Railways and Lighting Co., Ltd.

MR. CHARLES R. FOX, charge engineer at the Lancashire United Tramway Co.'s generating station at Atherton, Lancs., was on 6th inst. the recipient of a handsome oak dining-room clock, presented to him by the station staff and other officials, on the occasion of his marriage, which took place the following day.

General.—The Herne Bay U.D.C. has decided to increase the salary of MR. H. C. DUFTON, pier electrical engineer, from £2 10s. per week to £3 10s. per week from May 1st to September 30th.

MR. ED. BADHAM THORNHILL, A.M.I.E.E., who for 13 years was chief engineer at Taunton, has joined the staff of the Armorduct Manufacturing Co., Ltd.

MR. J. G. LORRAIN notifies that on and after June 24th his address will be Staple Inn Buildings, Holborn, W.C.

MESSRS. HANDCOCK & DYKES have removed from 1 to 11, Victoria Street, Westminster, S.W.

Obituary.—MR. J. E. NEALE.—We regret to learn that the death occurred in India on May 25th of Mr. John Edward Neale, son of the late Mr. Neale, superintendent of telegraphs, North Staffordshire Railway. Deceased, who was born in 1870, was trained under his father, and went to India in 1893 as assistant telegraph superintendent. He was promoted to be telegraph superintendent in 1898. We understand that Mr. Neale was recognised as one of the foremost telegraph engineers in India, and that he was consulted as an expert by other railways and the Government. He invented a voucher block instrument, known by his name, which is in use all over the main single lines of the I.P. Railway, and which has been largely adopted by other railways. The very large attendance at his funeral of officers, staff and native workmen, showed the esteem in which he was held in the service.

MR. J. JACKSON MARR.—The death occurred at his residence Sandon Promenade, Egremont, Cheshire, on Sunday last, of Mr. John Jackson Marr, electrical engineer. Mr. Marr, who was 71 years old, after serving with the firm of Messrs. Chadwick, ships' telegraph makers, of Bootle, joined the Edison & Swan Co., at Liverpool. In 1874 he started on his own account at Moorfields, Liverpool, and this establishment is still in existence.

We regret to announce that MR. JULIUS MITTELHAUSEN, M.I.E.E., who was closely identified with much of the pioneer work in connection with submarine telegraphy, passed away on the 13th inst., in his 82nd year. The interment will take place at Charlton Cemetery on Saturday, 17th inst., at 3 p.m.

NEW COMPANIES REGISTERED.

Birmingham Mica Co., Ltd. (116,048).—This company was registered on May 26th, with a capital of £2,000 in £1 shares, to take over the business of workers of and dealers in mica and other insulating materials, carried on at 250, Icknield Street, Birmingham, as the Birmingham Mica Co. The subscribers (each with one share) are:—A. Round, 21, Waterloo Street, Birmingham, solicitor; H. E. Ashdown, 8, Osborne Road, Handsworth, manager. Private company. The number of directors is not to be more than five; the subscribers are to appoint the first; remuneration as fixed by the company. Registered office, 250, Icknield Street, Birmingham.

Moscow Metropolitan Syndicate, Ltd. (116,059).—This company was registered on May 26th, with a capital of £20,000 in £1 shares, to acquire concessions and rights, to construct or acquire any railway or tramways in Moscow or elsewhere, and to equip, maintain and work the same by electricity, steam or other power, &c. The subscribers (with one share each) are:—H. Howard, 161, Cowick Road, Tooting, S.W., secretary; E. S. Ashman, 68, Bentham Road, South Hackney, N.E., clerk. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Registered by Vallance & Co., 28, Bishopsgate, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Davis Electrical Co., Ltd. (99,740).—Particulars of £2,000 debentures, created May 16th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £1,100. Property charged: The company's undertaking and property, present and future, including uncalled capital (subject to £2,000 first mortgage debentures). No trustees.

Electric Welding Co., Ltd.—A statement of the total amount outstanding on July 1st, 1908, in respect of mortgages and charges created prior to that date and not required to be registered under Sec. 14 of the Companies' Act, 1900, has been filed pursuant to Sec. 12 of the Companies' Act, 1907. Particulars: Mortgage or charge dated 1894, securing £29,400.

Bankfoot Power Co., Ltd. (98,134).—Particulars of £50,000 debentures, created April 25th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £15,000. Property charged: The company's undertaking and property, present and future, except uncalled capital (if any). No trustees.

English Electrical Co., Ltd. (112,639).—Issue on May 11th of £1,000 debentures, part of a series of which particulars have already been filed.

Metropolitan Electric Supply Co., Ltd. (25,395).—Return dated March 28th, filed April 27th, 1911. Capital, £1,500,000 in £5 shares (100,000 preference). 200,000 ordinary and 76,121 preference shares taken up. £5 per share called up on 195,936 ordinary and 76,121 preference. £1,360,285 paid. £20,320 considered as paid on 4,064 shares. Mortgages and charges: £498,000.

Particulars of £440,000 debentures, created by resolutions of June 20th, 1899, March 20th, 1900, and April 25th, 1911, and secured by trust deed dated July 4th, 1899, and deed of acknowledgment dated May 9th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £190,000. Property charged: Certain property in Willesden, Paddington and Whitehall Avenue, £6,457 Metropolitan Water Board 3 per cent. "B" stock; £5,000 G.W.R. 4½ per cent. debenture stock; and £5,000 L. & Y. 3 per cent. debenture stock, and company's general assets. Trustees: Ad. Lord John Hay and T. Stretch.

Lancashire Power Construction Co., Ltd. (77,202).—Particulars of £50,000 prior lien bonds, created March 23rd, and secured by trust deed dated April 27th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital, and £90,000 debenture stock and 27,202 £10 shares Lancashire Power Co. Trustees: S. C. Boulter and N. Spens.

Delhi Electric Tramways and Lighting Co., Ltd. (88,758).—Issued on May 22nd of £600 "bearer" debentures, part of a series of which particulars have already been filed.

London Telegraph Training College, Ltd. (92,661).—Particulars of £400 debentures, created May 25th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £300. Property charged: The company's undertaking and property, present and future. No trustees. A memorandum of satisfaction in full on May 29th, 1911, of debenture dated March 24th, 1909, securing £100, has also been filed.

Arc Lamps, Ltd. (Old Company) (70,795).—A memorandum of satisfaction in full on May 27th, 1911, of debentures dated December 18th, 1908, securing £4,000, has been filed.

Uxbridge and District Electric Supply Co., Ltd. (62,706).—Trust deed, dated May 23rd, 1911, to secure £75,000 debenture stock. Property charged: Lands and premises in Waterloo Road, Hillingdon West, Middlesex, and the company's undertaking and property, present and future, including uncalled capital. Trustees: H. Drake, Winswood, Crediton; and Sir James Fortescue Flannery, Bart., 9, Fenchurch Street, E.C.

George Bailey & Sons, Ltd.—Debenture, dated May 24th, 1911, to secure £250, charged on the company's property, present and future, including uncalled capital. Holder: E. Roobotham, The Terrace, Newbridge Crescent, Wolverhampton.

Engineering and Arc Lamps, Ltd. (116,030).—Particulars of £6,000 debentures, created May 26th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £5,500. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Alderley and Wilmslow Electric Supply, Ltd. (47,663).—Particulars of £15,000 debentures, created July 19th, 1900, and secured by trust deed of even date, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £10,000. Property charged: The company's undertaking and property, including uncalled capital. Trustees: W. W. Hopkins and F. E. Gripper.

Electrical Fittings Co. (1911), Ltd. (115,433).—Debenture dated April 28th, 1911, to secure £5,000 and 5 per cent. interest, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Samuel Heath & Sons, Ltd., Cobden Works, Leopold Street, Birmingham.

Stairways, Ltd. (115,307).—Particulars of £1,200 debentures, created April 20th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £1,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Candelaria Land Mining and Power Co., Ltd. (115,019).—Particulars of £500,000 debentures, created May 9th, 1911, and secured by trust deed of even date, filed pursuant to Sec. 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The whole of the issued capital, viz., 5,000,000 pesos, and 5,000,000 pesos of debentures of the Mexican Candelaria Co., S.A., and the company's undertaking and general assets. Trustees: Trustees, Executors and Securities Insurance Corporation, Ltd.

Winchester Electric Light and Power Co., Ltd. (50,868).—Debenture dated April 25th, 1911, to secure a maximum amount of £40,000, charged on the company's undertaking and property, present and future, including uncalled capital, and benefit of a contract with Corporation of Winchester and money to be paid pursuant thereto. Holders: Union of London and Smith's Bank, Ltd., Winchester.

Bogota Telephone Co., Ltd. (69,059).—Agreement dated September 30th, 1910, varying terms of two trust deeds (1) dated May 30th, 1905, securing £15,000 first mortgage debentures, and (2) dated December 12th, 1906, securing £25,000 second mortgage debentures. By the terms of the agreement, the company may issue £5,000 prior lien debentures, and have priority in point of charge on the company's undertaking and property, present and future, including uncalled capital, over first and second mortgage debentures and securities; interests due on May 1st, 1910, on first mortgage debentures reduced from 5 per cent. to 2½ per cent. per annum; and provisions for repayment of first mortgage debentures in trust deed are varied. The rights of the trustee of the second mortgage debenture trust deed are also varied.

Lancashire Dynamo and Motor Co., Ltd. (61,447).—Issue on May 8th of £5,600 debentures, part of a series of which particulars have already been filed.

Beck & Moss, Ltd. (69,298).—Return dated March 6th, filed March 7th, 1911. Capital, £2,500 in £1 shares. All shares taken up. £1 per share called up on £525. £525 paid. £1,975 considered as paid on 1,975 shares. Mortgages and charges: £300.

Telephone Co. of Egypt, Ltd. (17,824C).—A memorandum of satisfaction to the extent of £1,055 on May 10th, 1911, of debenture stock covered by deeds dated from July 27th, 1904, to October 27th, 1909, securing £200,000, has been filed.

Bude Electric Supply Co., Ltd. (95,137).—Return dated April 29th, filed May 3rd, 1911. Capital, £7,000 in £1 shares. All shares taken up. £7,000 paid. Mortgages and charges: £2,500 mortgage debentures.

Cambridge Electric Tramways Syndicate, Ltd. (79,744).—Return dated February 22nd, filed February 27th, 1911. Capital, £5,000 in £10 shares. 107 shares taken up. £9 0s. 4½d. per share called up on 90 shares, £10 per share on 10, and nil on 7. £911 12s. 1d. paid. Mortgages and charges: Nil.

Worcester Electric Traction Co., Ltd. (74,698).—Issue on March 9th, 1911, of £15,000 debentures, part of a series of which particulars have already been filed. A memorandum of satisfaction to the extent of £10,700 (being amount issued) on May 5th, 1911, of trust deed and other indentures dated from October 22nd, 1903, to December 30th, 1910, securing £35,000 debenture stock, has also been filed.

CITY NOTES.

Cape Town Consolidated Tramways and Land Co., Ltd.

THE meeting of this company was held on Tuesday at the offices 1, London Wall Buildings, E.C., Mr. Robert Littlejohn presiding.

The CHAIRMAN said that although the company had again made a loss—£1,045 for the year, the general outlook now, so far as the company's interests generally were concerned, was more hopeful than it had been for some years. During the past year the Estate Companies, the main source from which the company looked to derive not only substantial income, but return of capital, had not shown any activity or appreciation in value. No sales had taken place during the year of building sites on these properties. But the general conditions of business in the Cape Peninsula had lately begun to show decided improvement. The operating of the Camp's Bay Tramways nearly paid expenses last year. Indeed, the returns for the months of November and December last year, and for the months of January, February, March and April this year, showed a profit each month. They hardly expected that the winter months this year would show a profit. But if the operating of the tramways for the whole of this year—winter and summer combined—showed, as they hoped it would, a profit instead of a loss, it would be something better than they had seen in that connection for a long time, and one more reason for them to expect as they did that the worst of the period of depression at the Cape was past, and that a gradual improvement in business conditions there in general, and in the affairs of that company in particular, might now be looked for.

MR. LUDWIG BREITMEYER seconded the motion, and the report was adopted.

Underground Electric Railways Co. of London.

THE secretary has now issued a circular to shareholders and holders of income bonds, calling a meeting for July 3rd, to approve of the provisional agreements entered into for the sale of the generating station as part of the scheme for its transfer to a Joint Committee under conditions already explained in our pages. The *Financial News* says:—"By the Act a Joint Committee consisting of three directors of the Metropolitan District Railway Co. and three of the London Electric Railway Co. is constituted as a corporate body, and the company is empowered to sell the generating station undertaking to such Joint Committee, and the Joint Committee is empowered to create and issue a perpetual stock to be called Metropolitan District and London Electric Railways joint power house rent charge stock, in order to provide for the purchase price and the other purposes authorised by the Act. It is proposed that the price for the generating station undertaking should be £2,200,000 of power house rent charge stock at par, or the net proceeds thereof, such stock carrying a fixed perpetual dividend at the rate of 4 per cent. per annum, and that the sale shall take effect as on July 1st next. It is proposed to apply the balance of the purchase price remaining after payment of such expenses incident to the sale as may have to be borne by the company, first, in redemption of the entire issue of £1,000,000 of first power house debentures now charged on the generating station undertaking, and then towards the redemption of the 4½ per cent. bonds of 1993 of the company."

Manila Electric Railroad and Lighting Corporation.—The directors have declared a dividend of 1¼ per cent. ($1 25 per share) for the quarter ending June 30th on the capital stock.

Havana Electric Railway Co.—The report states (says the *Financier*) that the gross earnings of the railway and stage properties for the year to December 31st were $2,656,979; operating expenses were $1,365,640, leaving $1,291,338. Fixed charges and taxes amounted to $448,128, leaving $843,209. Adjustments amounted to $1,549, so that the surplus earnings for the year available for the use of the company were $844,759. The surplus, January 1st, 1910 (adjusted), was $1,017,975; total, $1,862,734. Dividends were paid during the year of 6 per cent. on preferred shares, $300,000, and 6 per cent. on common shares, $447,821—$747,821, leaving a surplus at January 1st, 1911, of £1,114,913. Stage lines:—Gross earnings, $384,376; operating expenses, $308,430; net earnings, $75,944.

Prospectuses.—*Toronto Suburban Railway Co.*—This company has this week been offering £540,000 4½ per cent. first mortgage debenture stock at 93½ per cent. The company has been formed to carry on an electric railway, light, heat and power business in certain of the suburbs and districts surrounding the city of Toronto. The prospectus contains particulars of proposed extensions to its existing electrical railway and other services.

The Jardim Botanico Tramway Co.—This company, which is chiefly owned, and is operated, by the Rio de Janeiro Tramway, Light and Power Co., has been offering £800,000 5 per cent. 40-year first mortgage bonds at 99½ per cent.

Prince Rupert Hydro-electric Co., Ltd.—The *Financial News* states that this company intends to issue $2,500,000 5 per cent. bonds and $3,000,000 common stock. The bonds authorised are $3,000,000 and the stock authorised is $5,000,000. The bonds will be issued at 92½, with a 40 per cent bonus of common stock.

The American Westinghouse Electric and Manufacturing Co.—The report of this company and its subsidiary companies in the United States for the fiscal year to March 31st shows (says the *Financier*) gross earnings of $38,119,000, or nearly nine million in excess of the preceding year, and over five millions greater than the earnings of the best previous year in the company's existence. The net manufacturing profits are $5,609,000, and other income added $1,515,000, making a total net income of $7,124,000. Deducting interest on bonds, debentures and collateral notes and other miscellaneous charges against incomes, there remains a surplus for the year of $4,881,000, being at the rate of over 12 per cent. on the entire capital stock of the company. The surplus on March 31st, 1910, was $5,669,000, which was increased by various items of profit throughout the year to $6,349,000. Adding the net income for the year, the surplus amounted to $11,230,000. Against this there have been charged dividends of preferred stock for the year at the rate of 7 per cent. per annum, plus the remaining balance of dividends accumulated but unpaid in previous years, $630,000; in adjustment of account property and plant, $1,193,000; to reserve for notes and accounts receivable, $590,000; depreciation of investments, $2,753,000. This leaves a surplus at the end of the fiscal year March 31st, 1911, of $5,964,000.

Provincial Tramways Co., Ltd.—The directors have declared an interim dividend of 8d. per share.

National Telephone Co., Ltd.—The transfer books of 3½ per cent. and 4 per cent. debenture stocks will be closed from 17th to 30th inst. inclusive, for the preparation of the warrants for the interest due July 1st.

Canadian General Electric Co.—A quarterly dividend of 1¾ per cent. on the common stock for the three months to June 30th (at the rate of 7 per cent. per annum) is announced.

Continental.—BELGIUM.—The balance-sheet of the Société d'Electricité du Bassin de Charleroi, of Charleroi, for the last financial year shows a profit of £9,812, as compared with only £8,381 in the preceding 12 months.

German Investment Companies.

THE Elektra Gesellschaft, of Dresden, which is partly an investment company and partly manages electric supply undertakings, reports gross profits of £29,900 for 1910-11, as compared with £21,900 in the preceding year. After meeting administrative expenses and allocating £5,000 to depreciation, as against £2,100 in 1909-10, the accounts show net profits of £18,500, as contrasted with £14,100 in the previous year. A dividend of 5½ per cent. has been declared on the ordinary share capital of £225,000, this rate comparing with 4½ per cent. in 1909-10. It is proposed to raise a further loan of £50,000 for the construction of the Schandau central station.

The Electricitäts Lieferungs Gesellschaft, of Berlin, whose share capital is mostly in the possession of the Berlin Electricity Works Co., had 27 electricity works under its administration in 1910, these being valued at £967,000, and other investments at £500,000. After devoting £31,000 to depreciation, as against £26,000 in 1909, and paying interest of £28,000 on the loan capital of £727,000, the accounts exhibit net profits of £92,000, as contrasted with £89,000 in 1909. A dividend of 10 per cent. has been declared on the ordinary capital of £750,000, being the same as in the preceding year. It has been decided to increase the ordinary share capital to £1,000,000 for the purpose of acquiring the Obererzgebirge central station from the A.E.G. for £200,000 in shares, whilst the balance of £50,000 has also been taken over by the A.E.G. at the price of 150 per cent., and is to be offered to the shareholders in the Lieferungs Gesellschaft at 157 per cent.

The Gesellschaft fur Elektrische Unternehmungen, of Berlin, which is financially interested in many lighting, traction and other enterprises in various countries, has a share capital of £2,250,000 and bond capital of £1,626,000. During 1910, the directors' report states, the employment of electric power was rendered accessible to further sections of the population, and both agriculturalists and manufacturers availed themselves to a greater extent of the facilities thereby afforded. As a consequence, the company was fully occupied in proceeding with extensions of electricity works in towns and with overland central stations, the additions representing a total of 35,000 KW. The receipts from interest and dividends experienced a large increase over the previous year, and the profits from the sale of securities were also greater. After providing for interest payments on bonds the accounts indicate net profits and balance forward of £245,000 for 1910, as against £219,000 in 1909, and a dividend of 9 per cent. has been paid, as contrasted with 8 per cent. in each of the four preceding years.

Aluminium Corporation, Ltd.

MR. KENNETH M. CLARK presided on Monday at Salisbury House, E.C., over the first ordinary meeting of the above company.

In moving the adoption of the report (see ELECTRICAL REVIEW, page 931), the CHAIRMAN said the original Aluminium Corporation was registered in April, 1907, with a capital of £500,000, and proceeded to acquire the necessary water rights and install plant. At that time the price of aluminium was about £200 a ton, but the directors did not appear to have then taken into consideration the probable effect of the increased output which was not only being provided for by their own works, but also by the extension of the works of all the other aluminium manufacturers of the world. With a view to expediting the output the board entered into certain onerous contracts, with the result that, on December 9th, 1908, the old corporation was placed in liquidation. The chairman proceeded to give a history of the various steps taken after the liquidation, which ended in the formation of the new company. Continuing, he said that, as soon as the scheme of reconstruction had been carried through, the new board proceeded at once to take steps to have the carbon works erected at Wallsend improved and placed in working order to enable the manufacturing operations to be increased. The bauxite works, which were only about half completed, were also dealt with and brought into working order. The dam at Dolgarrog was finished, over £17,000 being spent on this alone. Now that the severe difficulties of transport, technicality of manufacture and systematising of labour had been overcome, he had pleasure in being able to inform them that the whole of their works, from their mines in France to the recasting shop at Dolgarrog, were working systematically and well, and that in about two or three weeks' time, when the various works had been what he might call balanced, they would be thoroughly equipped to meet their competitors in the open market. No trading operations were carried out last year; but during the whole of this year metal had been regularly manufactured, and sales had been made in a manner the directors considered satisfactory. The keen competition naturally did not make for large profits, but with economical and efficient management they hoped in the future to show results which would justify the reconstruction. With regard to the accounts submitted, the issue of 5,000 participating shares of 1s. was absolutely necessary to enable the directors to place the £50,000 debentures which completed the minimum capital on which they felt they could continue the business. The 90,319 7 per cent. preference shares represented the shares which had been allotted to the creditors in satisfaction of their claims. They would also notice £9,242 of these shares reserved for claims not settled at the date of the accounts, and it was anticipated that this was just about £1,000 more than would be absolutely necessary. They would agree that it was a satisfactory result—that claims of £180,000 had been finally settled for under £100,000. On the assets side it would be seen they had spent £45,792 in the purchase and erection of plant, and the purchase of water rights, so as to complete the company's property, and the only item now outstanding in connection with water rights amounted to about £1,100. The item of £5,727 covered the whole of the expenditure during the period of the construction of works, including administration expenses, and about £1,500 interest on debenture stock. The investment account referred to the shares in the Bauxite Co., which he thought were of considerable value. He did not anticipate that the metal would ever appear on the market again at the unreasonable prices of days gone by, but he felt that the near future would see the sound policy of reasonableness with regard to aluminium, bring prosperity to all concerned in the manufacture. Personally, he was deeply interested in the company, and always felt that it was one which had strong hopes of success, and his experience during the last 18 months had strengthened that feeling.

MR. S. G. BIBBY seconded the motion.

A SHAREHOLDER asked if the £11,063 was the whole of the expenses of winding-up the old company; and also when they were likely to get a Stock Exchange quotation.

MR. RADCLIFFE asked what the company was doing in regard to the Aluminium Foyer Co.

MR. HILLIER wished to know whether the board thought there was any chance of paying a dividend as the result of the trading during the current year.

The CHAIRMAN said it was absolutely impossible to tell what their profits would be, because they could not tell what the price of aluminium was going to be. All he could say was that to the best of his belief they were manufacturing in a very economical way, and if the price of aluminium helped them, they certainly should be able to make a profit during the year.

MR. HILLIER asked if they were making aluminium at a profit now.

The CHAIRMAN said he thought they were, but they wanted to increase their output, which they thought would enable them to make aluminium at a low price.

MR. ROBERTSON LAWSON (a director) explained that they could not get a Stock Exchange quotation until after they had had the extraordinary meeting which would follow that one. The company had abandoned the Foyer Co.

A SHAREHOLDER asked what was the amount of aluminium manufactured up to date.

MR. LAWSON said that was not a wise question to ask. It would not be politic from the company's point of view to give information which might be useful to their competitors.

The report was then adopted.

An extraordinary meeting followed, when the CHAIRMAN moved the following resolution:—

> That pursuant to Clause 36 of the articles of association of the company the 95,214 fully-paid preference shares of the company which have been issued and are fully paid, be converted into preference stock, and that 284,371 ordinary shares of the company which have been issued and are fully paid, shall be converted into stock, whereof £78,048 shall be preference stock and £206,323 shall be ordinary stock, and that the last-mentioned preference and ordinary stock shall be divided amongst the holders of the ordinary shares rateably to their holding of such shares respectively.

Replying to MR. HUGHES, MR. LAWSON said the resolution was merely carrying out the scheme approved by the Court. The original shareholders of the old company were entitled to take up a certain number of shares in the new company with a liability of 5s. 6d., and the scheme provided that when this 5s. 6d. had been paid up, the 5s. 6d. should be converted into preference stock, and so bring these shares into the same category as the creditors' shares, which were, of course, allotted in full.

The resolution was seconded by MR. BIBBY, and agreed to.

German Electrical Companies.

THE Felten & Guilleaume Karlswerk Gesellschaft, of Mulheim, recommend for 1910 the payment of a dividend of 4 per cent., this comparing with 6 per cent. in the previous year. The manufacturing results at the Karlswerk were equal to those realised in 1909, but the costs arising from the disposal of the Frankfort dynamo works have had to be deducted.

The Land und Seekabelwerke, of Cologne-Nippes, state that although the prices of copper and lead were not subject to great fluctuations in 1910, yet the former experienced a backward movement throughout. On the other hand, the price of raw rubber rose in January, and reached a maximum in April, but then declined considerably down to the end of the year. These circumstances, and the continuance of keen competition, caused the profits to decrease, notwithstanding an increase in the turnover. After placing £5,900 to the depreciation fund, as compared with £6,700 in the preceding year, the accounts show net profits and balance forward of £18,200 for 1910, as against £28,100 in 1909. A dividend at the rate of 5 per cent. has been declared on the paid-up capital of £262,500, this contrasting with 8 per cent. in 1909.

The report of the Mix & Genest Telephone and Telegraph Works Co., of Berlin, states that the turnover in telephone apparatus in 1910 continued to be influenced by the lack of orders from the Imperial and State authorities, although compensation was obtained to some extent in private markets. The system employed at the Mayence central battery exchange, which was opened in April, 1911, was working satisfactorily, and a further development of the branch was consequently expected. An interest had been taken up in a new cable factory, which had been housed in space available at the company's works. After allocating the sum of £15,900 to depreciation, as compared with £17,400 in 1909, the accounts show net profits of £17,800, as against £20,000 in the previous year. It is proposed to pay a dividend of 3 per cent. on the share capital of £350,000, being the same rate as in 1909.

The Accumulatoren Fabrik Gesellschaft, of Berlin-Hagen, after maintaining a dividend at the rate of 12½ per cent. for seven years, has increased the distribution to 15 per cent. for 1910 on a share capital £400,000. According to the company's brief report, the volume of business turned out by the German and Austrian Works amounted to £872,500 in 1910, as contrasted with £871,000 in the previous 12 months. The accounts indicate the allocation of £12,800 to depreciation, as against £5,300 in 1909, and the net profits and balance forward reached £82,200, as compared with £79,400 in the preceding year. It is added that the orders on hand or invoiced by the end of March, 1911, were greater than in the corresponding period in 1910.

The directors of the Heddernheim Kupferwerk und Suddeutsche Kabelwerke, of Frankfort-on-Main, state in their report for 1910, which is the second year since the amalgamation of the two undertakings, that the degree of employment substantially increased, and the turnover rose from £1,137,000 in 1909, to £1,282,000 last year. As far as the cable department is concerned, the report mentions that the sale prices realised for insulated conductors and cables still left much to be desired, and the establishment of new competitive works contributed towards the prevention of an advance in prices. Satisfactory results were obtained by the improvement of the plant, and the production of specialities. After apportioning £14,700 to depreciation in 1910, as against £15,500 in the previous year, the accounts exhibit net profits of £37,100, as contrasted with £40,300 in 1909. A dividend of 7 per cent. has been declared on a share capital of £400,000, this being the same rate as in the preceding year.

The Hartmann & Braun Co., of Frankfort-on-Main, which has declared a dividend of 10 per cent. for 1910, as compared with 8 per cent. in 1909 and 11 per cent. in 1908, has just completed its tenth year as a limited company. After appropriating £7,100 for depreciation as against £6,800 in 1909, the accounts exhibit a net surplus of £21,000 as contrasted with £15,000 in the previous year. The turnover experienced an increase over 1909, but it was impossible to reach earlier levels. There was no lack of possibilities of sales, but the large firms now participated in an extraordinary way in the delivery of special articles and underbid even the maximum rebates both in regard to Government orders and foreign transactions, whilst the absorption of works by the large firms deprived the special works of good customers who formerly purchased instruments and manufactures from them.

The Sachsenwerk, Licht und Kraft Gesellschaft, of Dresden, in reporting an increase in the turnover in 1910, states that the production of generators, transformers, &c., advanced from 50,398 H.P. in 1909 to 75,380 H.P. last year. Various electricity works were built and the company also participated in the equipment of others. The unsound competition and conditions of prices became aggravated and unfavourably influenced the profits. After placing £5,400 to depreciation as against £3,400 in 1909, the net profits are returned at £10,800, as compared with £6,700 in the previous year. A dividend at the rate of 6 per cent. has been declared on the preference shares, as contrasted with 4 per cent. in 1909, the ordinary shares receiving no distribution. It has now been decided to reduce the ordinary capital and convert the shares into preference shares, and thus make the entire capital of a uniform class.

British Electric Traction Co., Ltd.

As briefly announced last week, the directors have issued their report and accounts for the year ended March 31st, 1911, to which are appended various schedules giving particulars of the items appearing in the balance-sheet and profit and loss account, and also schedules relating to the business of the Associated Companies. They state:—"It affords the directors satisfaction to be able to report a general improvement in the position and prospects of the company. The traffic receipts of the Associated Companies for the past year show a marked improvement, which promises to be maintained in the current year. The net profits of the Associated Companies show a substantial increase for the year 1910. For the most part, however, these increased profits have been added to the reserve and renewal funds, or have been otherwise applied in strengthening the position of the companies. The profit of the B.E.T. Co. from this source has therefore not increased by so large an amount as would otherwise have been the case. No increase of dividend is recommended by the directors for the past year, but they recommend placing £25,000 to reserve out of profits, as compared with £15,000 in the preceding year. The opportunities of promoting new electrical undertakings in this country with a prospect of reasonable profit under present conditions continue to be restricted, but whenever the conditions justify extensions of electrical business in this country the resources of the company will enable it to participate in them. Meanwhile, the directors hope that some of the foreign enterprises which have engaged their attention will mature during the current year. Further successful efforts have been made to reduce expenses, but in view of the large economies already effected the reductions cannot now be carried much further. Some changes on the board have been made and are referred to below. The directors desire to refer to the views they have expressed in previous reports on the subjects of the depreciation of assets and the reserve funds and in regard to the general position of the company. They consider the time has now arrived when the interests of the company will best be served by a reorganisation of the capital dealing with the arrears of dividend on the preference shares, and equitably adjusting the relations between the two classes of shares. The directors will place their proposals before the shareholders at an early date."

The subscribed share and debenture capital of the company at March 31st, 1911, was:—

£1,333,010 in ordinary shares of £10 each, fully paid.
£1,614,370 in 6 per cent. cumulative preference shares of £10 each, fully paid.
£1,464,245 in 5 per cent. perpetual debenture stock.
£489,596 in 4½ per cent. second debenture stock.

During the year the directors have purchased in the market £6,408 5 per cent. perpetual debenture stock, and £36,134 4½ per cent. second debenture stock of the company. The issued debenture stocks have been reduced by these amounts, and the difference of £12,393 between the nominal value and the purchase price has been transferred to reserve. The amount of reserve at March 31st, 1910, was £633,582. This account has since been debited with £6,319 loss on sale of Consols and credited with £1,675 net profit on sale of other investments, and adding the £12,393 referred to above, the reserve at March 31st, 1911, stands at £641,332. It will be further increased by the sum of £25,000 proposed to be transferred out of the profits of the year. In addition, reserves amounting to £4,053 have been made out of profits of the year against loss and depreciation of specific assets. The total of these reserves at March 31st, 1911, is £63,787. The Associated Companies have created depreciation and other reserve funds of their own, which amounted at December 31st, 1910, including balances carried forward, to £1,228,127. During the past year the directors have sold part of the large amount of Consols held by the company and have reinvested the proceeds in India 2½ per cent. stock and other securities yielding a larger return than is obtainable from Consols.

Creditors.—The total amount at March 31st, 1911, was £13,267, and in addition £44,736 debenture interest had accrued at that date and has since been paid.

Investments and Undertakings.—This item stands at £5,204,667, and consists of shares and debentures in shares and debentures in Associated Electricity, Tramway Supply, manufacturing and other companies, Consols and sundry securities and undertakings.

It is made up as follows:—

Consols and other British funds of the nominal value of £185,331, standing in the books at	£177,687
Debentures in various companies of the nominal value of £563,950, standing in the books at	527,596
Shares in various companies of the nominal value of £4,523,491, standing in the books at	4,360,299
	£5,065,583
Capital expended at Barrow, Brighton and Mumbles, less reserve of £18,500	139,084
	£5,204,667

The amount of sundry debtors and debit balances stands at £247,998, which is £199,950 less than at March 31st, 1910. Most of the debts paid off have been liquidated by the issue to this company of debentures and shares. Buildings and land now stands at £44,364. The item, expenditure on Acts of Parliament, &c., has been debited with the expenditure during the year. It is, however, being written down annually by 20 per cent., and now stands at £23,789. Stock stands at £8,623 after making provision for depreciation. Goodwill stands at £1,000, and is the balance of a larger amount. Furniture stands at £3,963, and is being written down annually by 10 per cent. Cash stands at £76,199.

The net profit, after applying £5,047 to writing down expenditure on Acts of Parliament, &c., and after reserving £4,053 against depreciation of undertakings worked by the company, buildings and freehold land, and doubtful debts, is £139,513, to which must be added the sum of £14,067 brought forward from last account, making a total of £153,580. After deducting the interest on the 5 per cent. perpetual debenture stock and the 4½ per cent. second debenture stock for the year, amounting to £93,533, there remains a balance of £60,047, out of which it is proposed to pay a dividend of 3s. per share on the preference shares, amounting to £24.216, and to transfer a sum of £25,000 to reserve, leaving a net balance of £10,832, which the directors propose should be carried forward. This dividend will bring the payment of the full dividend on the 6 per cent. cumulative preference shares of the company to September 30th, 1908, and the reserve will be increased from £641,332 to £666,332. The yield for the past year on the total investments and undertakings, standing in the books at £5.204,667, was 2·7 per cent., as compared with 2·63 per cent. for the preceding year on £4,997,845.

Since March 31st last Mr. E. Garcke has acted as sole managing director of the company. Mr. C. Shirreff Hilton and Mr. W. L. Madgen have resigned the positions of joint managing directors, but they remain directors of the company, and they have agreed to continue to act as chairmen and directors of various associated companies, and to perform other special services. Mr. George Cornwallis-West has been appointed a director of the company. The members of the board who act as chairmen or directors of associated companies receive special remuneration therefor in addition to the remuneration paid to them for their ordinary services as directors of the B.E.T. Co., but they pay to that company all fees received by them from the associated companies. Sir Charles Rivers Wilson proposes to vacate the position of chairman of the board after the general meeting, but will remain a director, and Mr. E. Garcke has been appointed to succeed him as chairman. The directors who retire this year are Sir Charles Fremantle and Mr. J. S. Raworth, and they will be proposed for re-election.

Messrs. Fred. W. Smith & Co., and Messrs. Deloitte, Plender, Griffiths & Co. retire, and offer themselves for re-election as auditors.

The tramways worked have a mileage of 407·01 (387·43 electric and 19·58 other power), as compared with 397·04 in the previous

year. The mileage of omnibus routes is 57·62. The passengers carried were 324,796,450, or 699,043 per route-mile, compared to 302,727,657 (674,797 per route-mile) in the previous year. The traffic receipts were £3,638 per route-mile compared with £3,480 in 1909.

The annual meeting was held on Thursday at the Holborn Restaurant, W.C.

Callender's Cable and Construction Co., Ltd.

THE annual general was held on Thursday last week, at Hamilton House, Victoria Embankment, E.C., Mr. Henry Drake presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 887), said that the profit realised for 1910 was somewhat in excess of that in the previous year, although the conditions which prevailed in the cable industry were practically identical in both periods, no material improvement in the business having occurred during 1910. The increase in trade, of which there were many indications, in the early part of last year, was not maintained, and the year was characterised by an absence of new enterprises. Evidences of coming improvement in the electrical industry generally that had been noted in the early part of the coming year seemed for the present to have disappeared. He also called attention to the item appearing in the accounts for the first time under the heading of the Uxbridge and District Electric Supply Co., Ltd., remarking that since the close of the year an issue of debenture stock in that company had been made by which their own expenditure in that connection would be reimbursed. Comparing the figures in the balance sheet with those of the previous year, the Chairman pointed out that there was as a result an available balance of £66,323, as against £68,452 in the previous year. The directors proposed to deal with that by paying a dividend on the ordinary shares at the rate of 10 per cent. per annum, of which 5 per cent. had already been paid, by paying a bonus of 5s. per share, and by carrying forward £40,073.

SIR J. FORTESCUE FLANNERY, Bt., M.P., seconded the motion.

MR. T. O. CALLENDER (managing director), commenting on the accounts, said he believed that all heavy constructional business in this country had been very bad during 1910. He had seen in one of the newspapers a statement, with regard to their report, that they did not appear to have profited much by the boom in trade. He was afraid that they had not seen any of that boom, and in discussing the actual facts of business during last year he had found others of his opinion—that the boom had not come into the engineering world at all. There had been no new enterprises undertaken in the country, and there had been no spirit of confidence to enable new works to be taken in hand. That deplorable situation continued to the end of last year, and though they seemed to notice these signs of lightening in the dark cloud, that had unfortunately passed away, and once more they had found themselves in the doldrums with absolutely nothing new doing. Indeed, he could not remember so thoroughly unsatisfactory a period for new electrical business as the two or three years they had just gone through, and he thought they would consider it as satisfactory that, in spite of all, they had not only maintained their position, but they had improved upon it, although the improvement had not been very great. Since Easter of the current year there had been a distinct improvement in business, and for the moment there had been a brightening up in their branch of the engineering trade, which was eminently satisfactory. It was also satisfactory that the existing electrical supply companies to whom they had to look for business had materially improved their position, and were beginning to secure the results anticipated at the time of their constitution. In fact, never had the electrical supply industry been in an healthier position. The anticipations they had formed some years ago were at last being fulfilled. It had been necessary, in view of the slackness of the home trade to push energetically for foreign work, and in almost every part of the world they were getting a fair share of the business. Although they had done well with the foreign trade, they had a heavy battle to fight. In one instance, at least, they had been informed by one of the engineers of a very large electrical supply company that an order which they had expected had been placed in Germany owing to the pressure brought to bear by the German Ambassador. They could imagine what they had to face when the German Ambassador personally interested himself in orders for cables against their company, and the matter was really becoming serious. They were wondering what would happen if, one of these days, they, too, were to have the assistance of a Government that would enable them to fight on a level basis with their competitors on the Continent. In the meantime they realised that it was necessary to strengthen their position in that country in a way something similar to what had been done by many of those abroad. He and other friends engaged in the supply of electrical machinery of various sorts had discussed the necessity of forming some kind of bank or financial institution which would put them in the way of being able to fight those very heavy influences which were now being used against them. One of these days, it might be this year, or next year, they would come to the shareholders and ask them to assist the directors to form such an institution, which was the only way in which British trade could be secured in any of the outlying portions of the world. In some cases, unfortunately, in the outlying portions of the Empire, business could not be obtained unless they were in the same strong position as some of their competitors. They were not in the least downhearted with what they had in front of them, and they believed it would be easily done, and with the assistance of their friends it would in due course be carried out. By that means they would be able to hold their position as they had held it in the past. All these things, as they could imagine, had made the year under review a heavy one for the directors. They had carried their fight not only to the uttermost parts of the earth, but to various countries on the Continent, and there they had carried out in many cases some important contracts and done very good work, which had been of immense value to the company. That would give them a slight indication of what they had had to do during the past year, and they were still carrying on their propaganda. Wherever it was necessary, they were opening offices in order to increase the business of the company, and the last field which they had tackled, and which they were still tackling, was South Africa, from which they had already received most important orders and where the prospects of additional, and, they hoped, a remunerative business, were exceedingly good. A certain amount of South African business had been lost to this country through the arrangements which were entered into with regard to the Victoria Falls supply, of which they were all well aware, and it was a little disturbing to find that, whilst money was not available for enterprises in this country, their bankers were willing to pour large sums into the lap of Germany for the purpose of carrying out work in our own Colony. In spite of that, there was a huge business available, and that was the business of which they hoped to get a fair share. Elsewhere, in Australia, South America, Mexico and, indeed, all over the world they were strengthening their position; they were pushing for trade, and they were getting some of that which was going, and had it not been for the money they had spent in past years, and which they still continued to spend in developing their foreign trade, he was afraid the results which the directors were laying before the shareholders now would not be quite so good as they were. With regard to the Anchor Co., they had to congratulate themselves on having taken the step they did seven or eight years ago in purchasing that undertaking, for whilst the heavy trade which Erith carried out had been very slack, the Anchor trade had been highly satisfactory and had added substantially to the profits shown in the balance-sheet.

The report was then adopted, and the retiring director re-elected.

Peel-Conner Telephone Works, Ltd.

THE annual meeting of this company was held at the offices, 71A, Queen Victoria Street, E.C., on Monday last.

MR. H. HIRST, in moving the adoption of the report (see ELECTRICAL REVIEW, page 933), referred first to the inception of the company, its past year's trading, and to its future. He said that the company was started because the present directors realised that there was going to be a very big telephone business both in this country and the Colonies and in foreign countries. The development of the common-battery system made it certain that within a few years much of the existing exchange plant might have to be scrapped, and the improved service obtained by the common-battery system would make telephony so much more popular that a great addition of new work all over the world was anticipated. The directors felt that, owing to the monopoly enjoyed by the National Telephone Co., and under the practice which they indulged in by buying their plant principally from foreign houses, it was not possible to establish an industry in this country earlier. But, on the Post Office taking over the management with the desire of buying its supplies from home manufacturers, every encouragement was given to those connected in similar industries in the production of common battery exchanges in this country. The Post Office, being desirous of taking full advantage of the more modern system of common battery exchanges, let it be known that they would prefer to confine their purchases to British products, if a sufficient and healthy competition of home producers could be created. Relying on their ability to manage works and men, and, assisted by one of the foremost telephone experts, now their managing director, Mr. M. S. Conner, the Peel-Conner company decided to enter the field. The work during the first financial period already justified their action. It would scarcely have been surprising if he had had to present a balance-sheet which would not have enabled them to declare a dividend this year. At the starting of new works one had to reckon with so many problematical figures and facts. The works must be equipped to efficiently cope with an assumed annual turnover. The time necessary in getting together plant, machinery, men, tools and patterns, must of course be speculative; more especially if (as they had done) a complete new set of apparatus had to be designed. The training of men was a very difficult problem, and meant a great deal of expense and patience, and success was not always in their hands, but he was pleased to say that they had made greater progress than they anticipated in that direction. They had not followed others. They had been original right through. It was very satisfactory to state that, because sufficient time had elapsed to prove that their efforts had been successful, their plant had found favour with purchasers in consequence of the great success of the Glasgow Exchange. As a result, they had had a considerable number of repeat orders from the Post Office, and had also received orders from abroad. At the opening of the Glasgow Exchange the Postmaster-General cordially congratulated them upon the successful installation of the New Central Telephone Exchange. Mr. A. M. Ogilvie, Assistant Secretary to the General Post Office, also spoke highly of the Glasgow switchboard as being of the largest size considered practical in any modern telephone system, and he fully believed that the construction, design and manner in which it had been carried out was up to the highest standard of work in the world, including the United States, where the telephone was most highly developed. He thought it a great triumph for the Peel-

Conner Co. that they had turned out a switchboard of this magnitude and efficiency. As the orders to which he (the chairman) had just referred had not reached them at the theoretical moment desired, to keep the works going under equal load, they naturally were held back until they could show something that they had done, and in consequence after this explanation they would better understand those figures of the balance-sheet which showed an apparent incongruity. He referred to stock in hand, which stood at rather a big sum, £66,000, cable in hand which was small (£32), and loans from bankers which were £16,000. For the reason above explained it had been impossible to complete all orders obtained during financial year under review. As a result, their stock in hand and the work in progress amounted to some £30,000 to £40,000 of finished, or nearly finished, work for contracts which were being executed in this financial year, and the profit on the manufacture of this large amount of stock would show in the coming year's work. Their capital of £100,000 was not sufficient to deal with such items of stock, and in consequence they relied on their bankers to assist to complete these contracts. With the large amount of work in hand (the large amount of finished goods being carried over to the new financial year) a satisfactory year was in front of them. Seeing that they had to thank the broad-minded and patriotic policy of the Post Office for calling them into life, it was not out of place on this occasion, for one who was so closely connected with the development of telephony in this country as he was, to make a few remarks on the attacks that had lately been levelled both by the technical and daily Press on the future management of the telephone system in this country by the Post Office, a question, as they would understand, in which the company was undoubtedly involved. So far from sharing their views that the Government was not competent to manage the telephone system, his opinion was that in this country nobody but the Government should manage such a public service. He was not in favour of State trading, but a service such as the telephone service was best in the hands of a monopolist institution, and that could only be the State. A monopoly implied responsibility. No company that once had had a monopoly given, troubled about any responsibility to the public. The Government, however, could at all times be made to act up to such responsibility through the force of public opinion. He thought they had started well by planting the industry in this country, "and making us self-reliant in this respect." It was of vital importance that in cases of war and national crises the telephone service should be in the hands of the Government. Both as a citizen and as a technical man, he thought that the telephone service should be in the same hands as the telegraph service. Nobody could foresee how soon in the future these two services would have to intercommunicate and rely upon each other, indeed, they already had some inter-working arrangements. Telephony nowadays was not merely a business proposition, it was a social necessity, and sacrifices in the common interest might have to be made to various sections of the community. It was not a company that only looked for dividends, but it was the Government department only that could deal with such conditions and concessions to society. The first step—the farmers' telephone at £3 per subscriber—had already been taken, and others, no doubt, would follow very shortly. Having given these four all-important reasons why the Government should handle the telephone service, he would particularly deal with the allegations that appeared in the Press, as to why they should not do so. They were of a threefold nature. First, it was alleged that the Government could not work it as efficiently as a private company could do. He, personally, did not think that a large organisation such as the company that supplied good telephone services for this country, could do it much cheaper than a Government, but if there should be any saving, it could not seriously affect the public, because it would probably mean only a small additional profit for the benefit of the shareholders. There was no benefit to the public at large. Secondly, the Post Office itself could not make the telegraphs pay, it was alleged; the reasons for this are obvious, and not necessarily the fault of the Post Office:—(*a*) The Post Office give a 12-word message throughout the United Kingdom for 6d. No private organisation could ever undertake a service of this magnitude at such a price. No other great country, neither Germany nor America, offered approximately such cheap rates. (*b*) The Post Office had developed the telegraph in all out-of-the-way places in the United Kingdom. If telegraphs were in the hands of the private individual, these out-of-the-way places would have no service at all. (*c*) The department sends Press messages at really a nominal price; this must show a loss for the department for the benefit of the general public. Under the same category might be added the facilities for sending wires by means of the greater number of permanent and temporary telegraph offices in this country than in any other. With these sacrifices to the public convenience and the common good, it must also be borne in mind that whatever might have been said in this country in recent years about "going back," the telegraph service in this country was acknowledged and admitted by experts throughout the world to be the finest in existence, speaking from a technical and constructional point of view. This brought him to the third allegation—viz., that the Post Office had not the proper staff of engineers to handle the telephone service. He had no hesitation in saying that the plans that the Post Office engineers had formed of a future telephone system in this country had been arrived at by a most careful study of all that existed in this direction, and were to-day so thorough and so far-reaching, and, above all, so well handled, that he was satisfied that in the hands of the engineering department of the Post Office the telephone service bade fair to reach the technical standard that he had just mentioned. The National Telephone staff was being taken over; why should they work under Government any worse than they had done under the present organisation? There was one more argument held up against the Post Office—*i.e.*, that the Government could not commercially push for subscribers as a private company could do. Now, they had constantly thrown up against them the fact that America possessed six million instruments and England only 600,000. This was not the fault of the Post Office; so far, they had hitherto only dealt with the trunk service, and the trunk service in this country was as cheap, if not cheaper, than any other, and it certainly was the best part of the telephone service in this country. The occasional delays that were sometimes experienced were, in some measure, due to the intercommunications with another company. The commercial extension was not at present a matter for discussion. The first condition was to have a good system throughout the country. Once good standard instruments were introduced, and a good service given, it would be an easy thing to get more subscribers in various ways. He ventured to mention one. Why should not the Post Office bring their mains to the houses and let duly qualified manufacturers' engineers install private houses, factories, offices and the like with up-to-date telephone service at defined rates and on certain conditions and tests, exactly as electricity undertakings do? This would mean a staff of inspectors in the service of the G.P.O., but under such a method of extending the telephone business, the Post Office would have at its command the service and enterprise of the entire electrical trade for getting subscribers. This was his own suggestion, but when the time came, many more or less contentious schemes were conceivable. He certainly saw no reason why the Post Office, on this account, should be hampered for taking over the telephone service. It might be urged that he was making this statement as an interested party, but he was no more—rather less—an interested party than the opposition who had launched the crusade against the Post Office. His statement had been made in the interest of this industry and in the interest of the public, without suggestion, inspiration or knowledge of the P.O. authorities.

Mr. J. Fraser seconded the motion.

Mr. H. Kahn asked whether the Post Office were going to scrap the old National Telephone stock.

The Chairman, in reply, said that that was the question which the Post Office and the National were at present wrangling about. What was going to be the result none of them could foretell, but it was quite clear that a great deal of that plant would have to be scrapped.

Mr. Kahn said he hoped, for the sake of that company, it was going to be the case.

The report was adopted.

Mr. E. G. Byng was re-elected a director.

The Russian A.E.G.—The report of the directors of the Russian A.E.G. for 1910 states that, in accordance with the general economic situation, the activity of the company has recently developed favourably. Although the Government, as in the two preceding years, made no financial provision for the allocation of orders, and the industry was consequently unable to exhibit any noteworthy revival, the economic position was favourably influenced by the extraordinarily good harvests. As the Government could no longer withhold large orders, particularly for the navy and the railways, and as the town authorities were endeavouring to raise considerable loans for the construction of waterworks, electric light and power stations, &c., it could be foreseen that Russian manufacturing industries would recover from the unfavourable conditions of recent years. The orders brought over by the company into 1911 were much greater than in the corresponding period in 1910. Including the balance forward, the accounts show net profits of £82,904 as compared with £76,930 in 1909, and it is proposed to pay a dividend of 7 per cent., as against 6 per cent. in the previous year, on an ordinary share capital of £700,000. A scheme for increasing the capital to £1,000,000 is under consideration; the amount to be issued this year is £100,000, leaving the balance of £200,000 to be raised in future years.

Aron Electricity Meter, Ltd.—The report of the directors for the year ending March 31st, 1911, states that the profit and loss account for the year, after providing for general charges and depreciation, shows a net profit of £27,521, making, with the balance of £5,354 brought forward, a total available profit of £32,874. Out of this amount the directors distributed in December last a dividend of 3 per cent. on the preference shares, absorbing £3,747, leaving £29,128 to be disposed of. The directors recommend the payment of a further 3 per cent. on the preference shares, absorbing £3,747, and making a total for the year of 6 per cent.; a dividend of 6 per cent. on the ordinary shares, absorbing £7,500, and a transfer to reserve towards goodwill and patents of £5,000, making this reserve £30,000, leaving a balance of £12,881. Out of this it is proposed to appropriate £7,000 towards writing off the expenses of the debenture issue of 1911, and to carry forward to next year's account the balance of £5,881. The past year's trading has been most satisfactory, the sales having again exceeded those of any previous year. The company's factories have been fully employed, and the necessary extensions to cope with the increased business have been carried out. The taximeter business is still progressing satisfactorily in England, Belgium and Austria.

Stock Exchange Notices.—Application has been made to the Committee to appoint a special settling day in, and to grant a quotation to, Marconi's Wireless Telegraph Co., Ltd. Further issue of 11,850 ordinary shares of £1 each, fully paid (Nos. 416,926 to 428,775)

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Aberdeen	June 7	3,962	+ 548	..	..	..	..	..
Ayr	„ 10	688	+ 83	4	1,134	+ 10	8	..
Bath	„ 10	2,228	+ 241	23	17,692	— 467	..	..
Belfast	„ 9	9,955	+1,924	10	45,767	+ 6,278	40	3
Birkenhead	„ 11	2,583	+ 232	10	11,758	+ 556	13·7	..
Birmingham Corp.	„ 3	14,495	+1,417	9	66,595	+ 3,885	56·5	..
Blackburn	..	..	..	..	..	..	..	..
Blackpool Corp.	„ 8	3,500	+1,975	..	10,390	+ 2,171	..	..
Blackpool-Fleetw'd	„ 10	2,282	+1,348	23	9,776	+ 427	..	..
Bolton	„ 11	5,481	+ 633	11	26,878	+ 2,348	26	..
Bournemouth	„ 7	3,942	+ 746	9½	17,279	+ 1,092	21·95	..
Bradford	„ 3	11,240	+1,187	9	50,368	+ 3,408	54·8	..
Brighton	„ 11	2,404	+ 531	10½	10,444	+ 1,025	9·5	..
Bristol	„ 9	15,786	+4,190	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	„ 6	470	+ 29	22	4,692	— 26	3·65	..
Barnsley	„ 6	382	+ 65	„	3,882	+ 168	..	..
Barrow	„ 6	584	+ 45	„	5,477	+ 250	5·87	..
Cavehill	„ 6	214	+ 28	„	1,619	— 60	..	..
Devonport	„ 6	1,031	+ 198	„	9,769	+ 872	8·85	..
Gateshead	„ 6	2,119	+ 210	„	21,454	+ 1,136	11·25	..
Gravesend	„ 6	439	+ 41	„	4,168	— 40	6·5	..
Greenock	„ 6	1,790	+ 246	„	14,447	+ 1,965	7·25	..
Hartlepool	„ 6	567	+ 95	„	4,995	+ 266	6·72	..
Kidderminster	„ 6	225	+ 34	„	2,028	— 17	..	..
‡Leamington	„ 6	332	+ 26	„	3,091	— 161	..	..
Merthyr	„ 6	414	+ 24	„	4,268	..	2·9	..
Metropolitan	„ 6	18,856	+3,605	„	17,369	+24,488	22	..
Middleton	„ 6	771	— 21	„	6,789	+ 347	8·5	..
Mid. Joint Com'tee	„ 6	12,312	+1,246	„	12,996	+ 4,913	..	..
Oldham—Ashton	„ 6	1,192	+ 42	„	12,020	+ 299	9·18	..
Peterborough	„ 6	248	+ 36	„	2,359	+ 82	5·31	..
Potteries	„ 6	3,912	+ 602	„	41,671	+ 3,922	29	..
Rothesay	„ 6	387	— 14	„	1,913	— 57	2·75	..
Southport	„ 6	647	— 15	„	5,554	— 94	8·17	..
S. Metropolitan	„ 6	1,936	+ 179	„	16,912	— 3	..	..
Swansea	„ 6	2,256	+ 189	„	24,333	+ 1,198	12·5	..
Tynemouth	„ 6	500	+ 36	„	3,796	— 54	3·75	..
Weston-s-Mare	„ 6	276	+ 39	„	1,185	— 246	3	..
‡Worcester	„ 6	612	+ 53	„	5,054	+ 88	5·75	..
Wrexham	„ 6	209	+ 28	„	2,062	+ 9	..	..
Yorks. Wool. Dist.	„ 6	2,216	— 327	„	22,171	+ 1,360	17	..
Miscellaneous	„ 6	488	+ 82	„	3,507	+ 198	..	..
Burnley	„ 10	3,014	+ 556	..	..	..	11·7	1
Burton-on-Trent	„ 11	633	+ 94	10	2,830	+ 120	6·6	..
†Bury	„ 4	1,349	+ 166	9⅔	11,193	+ 854	22·5	..
†Cardiff	May 27	2,281	+ 144	8	19,059	+ 957	..	..
†Chatham and Dist.	June 1	944	+ 34	22	17,302	— 196	14·98	..
Cork	„ 8	1,261	+ 178	23	10,976	+ 170	9·89	..
Croydon	..	..	..	..	..	..	..	..
Darlington	„ 10	470	+ 86	11	2,822	+ 229	..	..
Darwen	„ 9	594	+ 105	10	2,760	+ 286	4·36	..
Dover	„ 5	452	+ 88	9	2,111	+ 279	4·75	..
Dublin	„ 9	14,709	+3,838	..	124,159	+ 4,743	54·2	..
Dundee	„ 7	2,644	+ 117	8⅔	4,046	+ 36	15	..
East Ham	„ 10	2,423	+ 357	10½	11,103	+ 668	7·87	..
Exeter	„ 9	818	+ 177	10	3,426	+ 251	5·5	..
Glasgow	„ 10	41,774	+4,367	..	..	..	98	·75
Hastings	„ 8	2,561	+ 662	..	..	..	..	..
Huddersfield	..	..	..	..	..	..	..	..
Hull	„ 10	5,817	+ 458	10	28,831	+ 1,410	14·5	..
Ilkeston	„ 8	310	+ 67	10	1,360	+ 118	..	..
Ipswich	„ 10	1,180	+ 278	10	4,476	+ 598	10·5	..
†Kilmarnock	„ 3	168	+ 22	3	444	+ 7	4·2	..
Lancashire United	„ 7	3,085	+ 586	..	..	..	39	..
Leeds	„ 10	17,140	+3,157	10	77,861	+ 7,453	103	..
Leicester	..	..	..	..	..	..	..	..
Leith	„ 10	1,409	+ 160	10⅔	2,558	+ 308	8·72	..
Liverpool	„ 3	24,074	+1,926	22	244,868	+ 8,181	116	6·5
‡L.C.C.	May 31	90,108	+3,812	..	384,728	+19,881	139	6·7
London United	June 10	18,317	+4,848	..	141,624	+ 3,546	..	..
Lowestoft	..	..	..	..	..	..	9·5	..
Manchester	„ 10	35,867	+4,781	11	167,684	+13,229	183	..
Newcastle	„ 10	8,797	+ 872	..	44,514	+ 3,419	14·5	..
Newport	„ 3	1,463	+ 128	9	6,564	+ 808	14·5	..
†Oldham	„ 5	2,100	+ 324	10	20,303	+ 1,160	23·5	·5
Portsmouth	..	..	..	..	..	..	15·25	..
†Preston	May 31	774	+ 84	9	6,783	+ 284	..	..
Salford	June 5	10,312	+1,358	9⅔	46,123	+ 2,756	..	..
Sheffield	„ 13	13,935	+2,083	11½	72,087	+ 5,299	40	..
Southampton	„ 7	2,802	+ 532	10	11,463	+ 979	..	..
Southend-on-Sea	„ 7	1,695	+ 611	10	5,939	+ 1,033	..	..
South Shields	„ 10	1,494	+ 392	10	6,410	+ 1,075	..	..
†Swindon	„ 7	216	+ 70	..	1,522	+ 175	..	..
Tyneside	„ 7	1,275	+ 443	23	10,095	+ 970	..	..
Wallasey	„ 10	2,679	+ 798	10½	11,457	+ 2,112	..	..
Walthamstow	„ 10	2,048	+ 613	10	8,244	+ 1,058	9	..
West Ham	„ 1	5,550	+ 608	9	24,448	+ 2,896	15·25	..
Wolverhampton	„ 7	2 544	+ 645	10	9,950	+ 1,612	25	..
Cen. London Rly.	„ 10	9,822	—2,162	23	119,490	—10,407	6·82	..
City & S. Lon. Rly.	„ 11	6,449	— 167	23	76,188	+ 2,336	7·26	..
Dublin-Lucan Rly.	„ 9	389	+ 104	23	2,891	+ 14	7	..
G.N. and City Rly.	„ 10	2,582	+ 84	23	35,381	+ 1,418	3·5	..
L'pool Overh'd Rly.	„ 11	3,254	+ 470	..	31,849	+ 2,015	6·8	4·3
Llandudno-Col. Bay	„ 9	638	+ 320	27½	4,772	+ 175	..	..
London Elec. Ry. Co.	„ 10	26,585	+1,810	23	340,770	+15,270	21·25	..
Mersey Railway	„ 10	4,286	+ 96	23	47,652	+ 1,064	4·5	..
Metropolitan Rly.	„ 11	36,115	+1,160	..	391,763	+ 8,895	24·5	..
Met. District Rly.	„ 10	23,178	+1,333	23	259,515	+17,540	24	..
Anglo-Argentine	„ 10	98,271	+9,685	..	1,189,688	+123,169	..	..
§Auckland	April	16,689	+1,705	44½	175,751	+17,996	23·3	·6
Bombay (B.E.T.)	May 12	6,979	+ 848	19	54,602	+ 2,976	..	..
Brisbane	May	21,009	+2,609	..	..	..	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	June 10	7,504	+ 803	..	..	..	..	..
Cape Electric T. Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A.	April	8,495	..	..	18,286	..	20·5	..
§Lisbon	..	..	..	..	..	..	..	..
Madras	May 31	1,350	+ 28	..	14.000	+ 1,007	..	..
§Montevideo	May	15.8.7	—5 861	32	182,493	+ 10,190	..	..
Perth (W.A.)	June 9	3,151	+ 210	..	37,564	+ 1,578	29	..

* Compared with the corresponding period of 1910. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Evening.

THE position of the Stock Exchange markets is at the present moment like the lot of the classical policeman. None of the markets are at all happy, and the suspension of the Birkbeck Bank has created a feeling of anxiety and nervousness which is reflected in many of the Stock Exchange departments. At the same time, however, a steady investment business continues to be done, and brokers with purely investment connections report that their clients keep them going with orders better than might have been expected at a time when prices are so decidedly dull.

In spite of the splendid advertisement which Electricity Supply companies are receiving from the illumination preparations in the streets, the market for these particular shares remains hopelessly quiet. Some people ask, in a jesting sort of way, whether it is right to be a bull of electricity shares or gas stocks, but as we were pointing out weeks ago, the fact of the Coronation coming in the middle of June, when the nights are shortest, will have the effect of giving the supply companies little advantage in the matter of selling additional current. Of course, it must make a certain amount of difference, and, as we have just said, it will afford a fine advertisement; but, so far as dividends are concerned, the benefit to be derived is likely to be so small as to be practically negligible.

The Publicity Committee has a scheme on hand for another advertising campaign, and money spent in this direction ought to prove a good investment, provided the arrangements are carried out with business-like sagacity. This, however, is another factor which has had no effect upon the prices of shares, and the only changes this week are ⅛ rise in the price of Charing Cross Preference, and a fall of the same amount in Edmundson's Ordinary. City of London Debenture is a point to the good. The issue of Electric Supply Corporation Debenture stock, which was made at 90, resulted in the early purchasers—who were practically underwriters—being left with no less than 98 per cent. of the stock, the public response having been so poor that out of £60,000 offered only £1,200 was subscribed. No attempt has been made to establish a market in the security.

Home Railways are in poor case, and the chief feature of the list over-leaf is a drop of 2½ points in Metropolitan District Ordinary, which, in proportion to the quotation, is larger than the 2½ loss sustained by Metropolitan Consolidated stock. Central London Ordinary has eased off, and City and South London, after having been rather harder, fell back to 32, the reason for these falls being that weak speculative holders have been compelled to sell. The whole market being depressed, the jobbers were anything but willing to put fresh stock on their books; and, as usual, the amount of the fall has been disproportionate to the stock which has changed hands. On the other hand, there has been a good inquiry for the 6 per cent. Income Bonds of the Underground Electric Railways, and the price has risen 4, while improvements have been secured by City and South London Prior charge securities.

British Electric Traction Preference rose ⅛ upon a report which seems to us to be distinctly poor, although in some quarters a very fair face is being put upon the figures. There is at least one good thing to be said in its favour, which is, that the directors announce that they are about to lay proposals before the shareholders for the reorganisation of the company's capital account. It may be hoped that the work will be undertaken in a spirit which, however disagreeable the measure may be to the shareholders, will bring the capital into true line with the assets of the company, but how a great part of its holdings is to be valued, we must admit to be a very difficult problem.

The earthquake in Mexico had the natural result of reducing prices in the Canadian-Latin group. Mexican Light and Power issues have fallen, but Mexican Trams shares have put on a point, both classes of bonds being a little easier. Canadian General Common lost 3, and shrewd people seem to think that Canada as a land of financial promise is being a little overdone. Sao Paulo Trams at 185½ are only ¾ lower, and maintain an exceptionally firm front, despite their long rise; while, amongst other colonial and foreign issues, Anglo-Argentine Trams Preferences have resumed their advance. A small decline in Rio Trams has to be noticed, and in this section generally there is a quiet absorption of the best class issues. Northern Light and Power Bonds fell 7 upon a little pressure to sell, which was quite unexplained, and which puzzled the market in no small manner. The Havana Electric Railway has doubled its dividend on the Common shares, which are to receive 6 per cent. for 1910, as against 3 per cent. for 1909.

The manufacturing group is distinguished chiefly by a fall of 10 points in Crompton Debenture, a little stock coming in without finding ready buyers. Edison & Swan shares continue their advance, and are substantially better on the week; but the Aron report, while considered satisfactory, served to put the price down ⅛, the good features having apparently been discounted in the rise which took place earlier. Henleys and India-Rubber shares are both a little easier, and Dick Kerrs lost a small fraction.

Marconis are the chief feature in the Telegraph market, and show a rise of no less than $\frac{5}{32}$, this bringing the price up to practically £2 a share. A great part of the persistent demand continues to come from Ireland. American Telephone and Telegraph stock has had a good advance on Wall Street purchases, but the Anglo-American Telegraph group and Direct United States shares have weakened slightly. West India and Panama Ordinary have begun to rise again. National Telephones are very quiet, and an improvement of ¼ in the Preferred stock is the only quotable change.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations June 13th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	*	5½	5½	8 — 9	..	6 2 3
Do. 4½ % Pref.	10	4½	4½	9 — 10	..	4 10 0
Do. Second 6 % Pref.	10	6	6	10⅛ — 10⅝	..	5 12 11
Do. 4½ % Deb. Stock	Stock	4½	4½	102 —104	..	4 6 7
Brompton & Kensington, Ord.	5	10	10	7⅞ — 8¼	..	6 1 3
Do. 7 % Cum. Pref.	5	7	7	7⅝ — 8	..	4 7 6
Central Electric Supply, 4 % Guar. Deb.	100	4	4	98 —101 xd	..	3 19 3
Charing Cross, West End & City	5	5	5	3⅞ — 4⅛	..	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅜	+ ⅛	4 12 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞ — 4⅛	..	5 2 10
Do. Do. 4 % Deb.	100	4	4	96 — 98	..	4 1 8
Chelsea, Ord.	5	4†	5	4 — 4½	..	5 11 1
Do. 4½ % Deb.	Stock	4½	4½	100 —102	..	4 8 3
City of London, Ord.	10	7	7	11⅜ — 12½	..	5 14 3
Do. 6 % Cum. Pref.	10	6	6	12 — 13	..	4 12 4
Do. 6 % Deb.	Stock	5	5	121 —125	+1	4 0 0
Do. 4½ % Second Deb.	100	4½	4½	101 —104	..	4 0 0
County of Durham, 5 % First Mort. Deb.	Stock	5	5	92 — 94	..	5 6 5
County of London, Ord.	10	5	5	7⅜ — 8⅛	..	6 3 1
Do. 6 % Pref.	10	6	6	10⅝ — 11⅜	..	5 7 5
Do. 4½ % Deb.	Stock	4½	4½	109 —111	..	4 1 10
Do. 4½ % Second Deb.	Stock	4½	4½	99 —102	..	4 8 3
Edmundson's, Ord.	5	Nil	Nil	9/16 — 11/16	— ⅛	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2⅛ — 3	— ⅛	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	86 — 89	..	5 1 2
Folkestone	5	5½	6	4½ — 4⅝	..	6 9 9
Do. 5 % Cum. Pref.	5	5	5	4⅛ — 5¼	..	4 15 3
Do. 4½ % First Deb.	100	4½	4½	97 —100	..	4 10 0
Hove	5	8½	9½	6¾ — 7⅛	..	6 11 0
Kensington & Knightsbridge, Ord	5	8	9	7 — 7¾	..	6 2 0
Do. 4 % Deb.	Stock	4	4	93 — 95	..	4 4 3
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	80 — 84	..	5 7 2
London Electric, Ord.	3	2	2	1⅞ — 2⅛	..	2 16 5
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	..	5 17 1
Do. 4 % First Mort. Deb.	Stock	4	4	91 — 94	..	4 5 1
Metropolitan	5	5	5	3¾ — 4	..	6 5 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅜	..	4 16 0
Do. 4½ % First Mort. Deb.	Stock	4½	4½	101 —104	..	4 6 7
Do. 3½ % Mort. Deb.	Stock	3½	3½	86 — 89	..	3 18 8
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	98 —100	..	4 10 0
Newcastle-on-Tyne	5	4	4	3⅞ — 4⅛	..	4 14 2
Do. 5 % Pref., Non. Cum.	5	5	5	4 — 4½	..	5 11 1
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99 —102	..	4 18 0
Notting Hill	10	7½	8	12 — 12⅜	..	6 5 6
Oxford	5	7	7½	6⅜ — 6⅝	..	5 9 5
St. James' and Pall Mall, Ord.	5	10	10	8¾ — 9¼	..	5 8 1
Do. 7 % Pref.	5	7	7	6¾ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	86 — 88	..	3 19 7
Smithfield Markets, Ord.	5	Nil	Nil	1⅜ — 1½	..	Nil
South London, Ord.	4	5	5	3 — 3¼	..	6 3 1
Do. 5 % First Mort. Deb.	100	5	5	101 —104	..	4 16 2
South Metropolitan, 7 % Pref.	1	7	7	1⅛ — 1¼	..	5 12 0
Do. 4½ % First Deb. Stock	100	4½	4½	97 —100	..	4 10 0
Urban, Ord.	5	5	5⅝	⅞ — 1	..	18 15 0
Do. 5 % Cum. Pref.	5	5	5⅜	2⅝ — 3	..	6 5 5
Do. 4½ % First Mort. Deb.	100	4½	4½	87 — 89	..	5 1 2
Westminster, Ord.	5	10	10	7¾ — 8¼	..	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	5 — 5⅛	..	4 3 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅛ — 5⅜	..	5 4 4
Calcutta, Ord.	5	8	8½	6⅜ — 7⅛ xd	— ⅛	5 19 4
Do. 5 % Pref.	5	5	5	4⅝ — 5⅛	..	4 13 0
Calgary Power, 1st Mort. Bds.	100	5	5	96 — 98	..	5 2 0
Canadian Gen. El. Com.	$100	6	6	108 —111	— 3	5 8 1
Do. 7 % Pref.	$100	7	7	121 —124	..	5 12 11
Cordoba Lt., Power and T., Ord.	1	..	6	13/16 — 15/16	..	6 8 0
Do. 5 % Deb.	100	5	5	94 — 97	+1	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	..	6	97½ — 99½	..	6 0 7
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	87 — 90	..	5 11 1
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	83 — 85	— ½	5 17 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	Nil	1/16 — 3/16	..	..
Do. 6 % Pref.	1	6	6	13/16 — 15/16	..	8 6 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	103¾ —105½	..	4 14 9
Madras, Ord.	5	Nil	Nil	3 — 3½	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	94 — 96	..	5 4 9
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	88 — 90	— ½	5 11 1
Mexican Lt. & Power, Common	$100	4	4†	82½ — 84½	—2	4 14 8
Do. 7 % Cum. Pref.	$100	7	7	106 —108	—1	6 9 8
Do. 5 % 1st Mort. Gold Bds.	..	5	5	94¼ — 95¼	..	5 5 0
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	89½ — 91½	..	5 9 3
Montreal, Lt., H. and Power	$100	..	8	164 —167	+2	4 15 10
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	68 — 65	—7	7 13 10
River Plate, Ord.	Stock	9	10	218 —228	..	4 7 9
Do. 6 % Non-Cum. Pref.	Do.	6	6	107 —114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	104 —106	..	4 15 3
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital	$100	5	5	115 —118	..	4 4 9
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	109 —111	..	4 10 1
Do. 4½ % Per. Deb.	Stock	4½	4½	102 —104	..	4 6 7
Toronto Power, 4½ % Deb.	Do.	4½	4½	101 —103	..	4 8 3
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	93 — 95	..	5 5 3
Victoria Falls Power, Pref.	1	Nil	Nil	3½ — 1 3/32	..	Nil
Do. (new)	1	..	Nil	1/16 — 1	..	Nil
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	..	6	108 —110	..	5 9 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	Nil	7⅜ — 7⅞	..	Nil.
Do. 5 % Deb. Red.	Stock	5	5	99½ —101½	..	4 18 6
American Telep. & Teleg., Cap.	$100	8	8	156 —158	+3½	5 1 3
Do. Collat. Trust	$1000	4	4	96 — 98	+ ½	4 1 8
Anglo-American Telegraph	Stock	3⅝	3⅝	69 — 71	..	5 5 3
Do. 6 % Pref.	Do.	6	6	113 —114	— ½	5 5 3
Do. Def.	Do.	25/-	30/-	26⅜ — 26⅞	— ⅛	5 11 7
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	101 —103	..	4 17 1
Chili Telephone	5	8	6†	7 1/16 — 7 5/16	..	5 11 11
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	88 — 90	..	4 8 11
Cuba Telegraph	10	6	6	9⅞ — 10⅜	+ ⅛	5 12 11
Do. 10 % Pref.	10	10	10	17½ — 18½	..	5 9 7
Direct Spanish Telegraph, Ord.	5	4	4	3⅞ — 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	8⅜ — 8⅞	..	5 14 8
Do. 4½ % Debs.	50	4½	4½	101 —103	..	4 7 5
Direct United States Cable	10	4	5	7½ — 8	— ⅛	6 5 0
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	100 —102	..	4 9 1
Eastern Telegraph, Ord. Stock	Stock	7	7	137 —140	..	5 0 0
Do. 3½ % Pref. Stock	Do.	3½	3½	84 — 86 ex	..	4 1 5
Do. 4 % Mort. Deb.	Do.	4	4	101 —103	+ ½	3 17 8
Eastern Extension	10	7	7	13½ — 14	..	5 0 0
Do. 4 % Deb.	Stock	4	4	101 —103	..	3 17 8
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99½ —101½	..	3 18 10
Globe Telegraph and Trust	10	5⅞	5⅞	11¼ — 11⅝	..	5 0 0
Do. 6 % Pref.	10	6	6	13⅝ — 13⅞	..	4 8 1
Great Northern Telegraph	10	18	18	31½ — 32½	..	5 10 9
Indo-European Telegraph	25	13	13	56¼ — 58½	..	5 11 1
Mackay Companies Common	$100	4½	5	93 — 96	..	5 3 1
Do. 4 % Cum. Pref.	$100	4	4	78 — 80	..	5 0 0
Marconi's Wireless Telegraph	1	Nil	Nil	1 29/32 — 2 1/32	+ 5/32	Nil.
Monte Video Telephone, Ord.	1	6	6	7/16 — 1/2	..	6 0 0
Do. 5 % Pref.	1	5	5	3/8 — 7/16	..	5 10 4
National Telephone, Pref.	Stock	6	6	104½ —105½	+ ½	5 14 0
Do. Def.	Do.	6	6	127 —129	..	4 13 0
Do. 6 % Cum. 1st Pref.	10	6	6	10 — 10⅜	..	5 11 7
Do. 6 % Cum. 2nd Pref.	10	6	6	10 — 10⅜	..	5 11 7
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5⅛ — 5⅜	..	4 6 11
Do. 3½ % Deb.	Stock	3½	3½	99 —101	..	3 9 4
Do. 4 % Deb.	Do	4	4	99 —101	..	3 19 2
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100 —101	+ ⅛	4 9 1
Oriental Telep. and Elec.	1	8	6†	1⅜ — 1 11/16	..	4 8 3
Do. 6 % Cum. Pref.	1	6	6	1⅛ — 1⅜	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	87½ — 89½	..	4 9 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	100 —102	..	3 18 5
Reuter's	8	5	5	8¼ — 8⅝ xd	..	4 12 10
Submarine Cables Trust	Cert.	6	6	131 —134	..	4 9 7
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	100 —102	..	4 8 3
United River Plate Telephone	5	8	6†	7⅜ — 7 13/16	..	5 2 5
Do. 5 % Cum. Pref.	5	5	5	5⅜ — 5⅝	..	4 8 11
West Coast of America	2½	2½	2½	1⅝ — 1⅞ xd	..	6 5 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	99½ —101½	..	3 18 10
West India and Panama Teleg.	10	Nil	2	2⅜ — 2⅝ xd	+ 1/16	7 12 5
Do. 6 % Cum. 1st Pref.	10	6	6	10⅛ — 10⅝ xd	..	5 12 11
Do. 6 % Cum. 2nd Pref.	10	14½	6	9⅛ — 9⅝ xd	..	6 1 6
Do. 5 % Debs.	100	5	5	102 —104	..	4 16 2
Western Telegraph, Ltd.	10	7	7	13½ — 14½	..	4 18 8
Do. 4 % Deb.	Stock	4	4	101 —103	..	3 18 10
Western Union Tel., 4 % Bnds.	$1000	4	4	103 —108	..	3 14 1
Do. 4½ % Fdg. Bonds	$1000	4½	4½	103 —109½	..	4 7 10

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations June 13th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	¼ — ⅛	..	Nil
Do. 5 % Pref.	1	5	5	⅝ — ¾	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5
Brit. Elec. Trac., Ord.	10	Nil	Nil	1/16 — 1/8	..	Nil
Do. 6 % Pref.	10	3	..	4½ — 4⅝	+ ⅛	..
Do. 5 % Deb.	100	5	5	96 — 99	+1	5 1 0
Do. 4½ % 2nd Deb.	100	4½	4½	78 — 80	..	5 12 6
Central London Railway, Ord.	100	3	3	72 — 74	..	4 0 0
Do. Pref.	100	4	4	87 — 89	..	4 9 11
Do. Def.	100	2	2	62 — 64	..	3 2 6
Do. 4 % Deb.	100	4	4	104 —106	..	3 15 6
City & South London, Ord.	100	1½	1½	31½ — 32½	–1	4 12 4
Do. 5 % Pref., 1891	100	5	5	109 —111	..	4 10 1
Do. Do. 1896	100	5	5	105 —108	+1½	4 12 7
Do. Do. 1901	100	5	5	104 —107	+1	4 13 6
Do. Do. 1903	100	5	5	103 —106	..	4 14 4
Do. 4 % Deb.	100	4	4	102 —104	+1	3 16 7
Dublin United Trams, 6 % Pref.	10	6	6	12½ — 13½	..	4 10 7
Great Northern & City, Pr'f. Ord	10	Nil	Nil	⅝ — 1⅛	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	Nil	1½ — 2	..	Nil
Do. 4½ % Deb.	100	4½	4½	75 — 80	..	5 12 6
Isle of Thanet Trams, 5 % Pref.	5	1½	2½	2¼ — 2⅝	..	4 10 11
Do. 4 % Deb.	100	4	4	79 — 84	..	4 15 3
Lancashire United, 5 % Deb.	100	5	5	82 — 84	..	5 19 1
London Elec. Railw'ys, 4 % Deb.	100	4	4	98 —100	..	4 0 0
London United Trams, 5 % Pref.	10	Nil	Nil	4 — 4⅛	+ ⅛	Nil
Do. 4 % Deb.	100	4	4	76 — 79	..	5 1 3
Metropolitan Railway Consol.	100	1	1⅜	48¼ — 48⅝	–⅛	2 16 4
Do. Surplus Lands	100	2⅜	2⅜	68 — 70	..	3 18 7
Do. 3½ % Deb.	100	3½	3½	93 — 95	..	3 13 8
Do. 3½ % Pref.	100	3½	3½	90 — 92	..	3 16 1
Do. 3½ % Con. Pref.	100	3½	3½	89 — 91	..	3 16 11
Metropolitan District Ord.	100	Nil	Nil	29⅜ — 30¼	–¼	Nil
Do. 6 % Deb.	100	6	6	148 —150	..	4 0 0
Do. 4 % Deb.	100	4	4	98 —100	..	4 0 0
Do. 4 % Prior Lien	100	4	4	102 —104	..	3 16 11
Do. 4½ % First Pref.	100	..	3½	89 — 91	..	3 11 5
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 10 11
Metropolitan Elec. Trams, Ord.	1	5	5½	2⅜ — 1 1/16	..	5 6 8
Do. Def.	1	Nil	Nil	⅞ — 1	..	Nil
Do. 5 % Pref.	1	5	5	3⅛ — 1 7/16	..	4 17 0
Do. 4½ % Deb.	100	4½	4½	102⅜ —104⅜	..	4 6 2
Do. 5 % Deb.	100	5	5	100¼ —103⅛	..	4 16 7
Potteries, Ord.	1	2	..	⅜ — ⅝	..	..
Do. 5 % Pref.	1	5	5	⅜ — ⅝	..	6 19 2
Do. 4½ % Deb.	100	4½	4½	87 — 90 xd	+1	5 0 0
South Metro. Trams, 6 % Pref.	1	3	..	⅞ — 1⅛	..	..
Do. 4 % Deb.	100	4	4	75 — 80	..	5 0 0
Underground Elec. Railways 5 % Prior Lien	..	5	5	100 —101	..	4 19 0
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	Nil	10/-	67 — 69	+¼	0 14 6
Do. Power House Debs.	100	..	4	100 —102	..	3 18 5
Yorkshire (West Riding), Ord.	5	Nil	Nil	⅛ — ⅜	..	Nil
Do. 6 % Pref.	5	Nil	Nil	2¼ — 2½	..	..
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5	5⅛ — 5⅜	+ ⅛	4 13 0
Do. 2nd Pref.	5	5	5	5 — 5⅛	+ ⅛	4 15 3
Do. 4 % Deb.	100	4	4	96 — 98	..	4 1 8
Do. 4½ % Deb.	100	4½	4½	101 —103	..	4 7 5
Do. 5 % Deb.	100	5	5	100½ —102½ xd	..	4 15 3
Auckland Trams, 5 % Deb.	100	5	5	104½ —106½	..	4 13 11
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅞ — 11⅜	+ ⅛	5 5 6
Do. 4½ % Deb.	100	4½	4½	98 —100	..	4 10 0
Do. 5 % 2nd Deb.	100	5	5	98 —100	..	5 0 0
Brisbane Trams Invs., Ord.	5	8½	8½	6⅛ — 6⅜	..	6 5 11
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
B. Columbia Elec. Rly., Def.	100	8	8	146 —150	..	5 6 8
Do. Pref. Ord.	100	6	6	127 —130	..	4 12 4
Do. 5 % Pref.	100	5	5	110 —112	+ ½	4 9 3
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	102 —105	..	4 5 9
Do. 4½ % Con. Deb.	100	4½	4½	101½ —103½	..	4 7 0
Calcutta Trams, Ord.	5	4½	5	5¼ — 6	..	4 3 4
Do. 5 % Pref.	5	5	5	5¼ — 5⅜	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	102 —105	+1	4 5 9
Cape Electric Trams	1	Nil	Nil	⅛ — 1/16	..	Nil
City Buenos Aires Trams (1904)	5	5	5	5⅛ — 5⅜	..	4 5 1
Do. 4 % Deb.	100	5	5	96 — 99	..	5 1 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 — 98	..	5 2 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	100½ —102½	..	4 17 7
Kalgoorlie Elec. Trams	1	Nil	Nil	3/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	94 — 97	..	5 3 1
Do. 6 % B Deb.	100	6	5	66 — 70	..	7 2 10
La Plata Elec. Trms, Prf, 17/6 pd.	1	6	6	⅝ — ¾	..	6 8 0
Lisbon Elec. Trams, Ord.	1	6	6	1 — 1⅛	..	4 16 0
Do. 6 % Pref.	1	6	6	1 — 1⅛	..	4 16 0
Do. 5 % Deb.	100	5	5	98 —102	..	4 18 0
Madras Elec. Tr. (1904), Deb.	100	5	5	96 — 98	..	5 2 0
Manaos Trams & Lt., 1st Deb.	100	..	5	94 — 97	..	5 3 1
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100 —102	..	4 18 0
Mexico Trams Com.	$100	6	7	124 —126	+1	5 11 1
Do. Gen. Con. 5 % Bonds	..	5	5	94½ — 96½	— ½	5 3 8
Do. 6 % Bonds	100	6	6	100 —102	— ½	5 17 8
Para Elec. Rlys. & Lt., Ord.	5	..	10	7 — 7½	..	6 17 11
Do. 6 % Pref.	5	6	6	5⅝ — 5¾	..	5 2 2
Do. 5 % 1st Deb.	100	5	5	99 —101 xd	..	4 19 0
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	1⅛ — 1⅜	..	2 13 4
Do. 5 % 1st. Deb.	100	5	5	104 —106	..	4 14 4
Rangoon El. Tr. & Sup., Pref.	5	6	6	5½ — 5⅝	..	5 4 4
Do. 4½ % 1st Deb.	100	4½	4½	99 —102	..	4 8 3
Rio de Janeiro Trams	$100	2	5	116 —117	+ ¼	4 5 6
Do. 1st Mort. 5 % Bonds	..	5	5	103 —104	..	4 16 2
Do. 5 % Mort. Bonds	100	5	5	95½ — 96½	— ½	5 3 8
Sao Paulo Tram, Lt. and P.	$100	10	10	184 —186½	— ¾	5 7 3
Do. 5 % 1st Deb.	$500	5	5	102 —104 xd	..	4 16 2
Singapore Trams, 5 % Deb.	100	5	5	82 — 86	..	5 16 3
Southern El. Tr. B.A., 5 % Deb.	..	5	5	97 — 99	..	5 1 0
Un. Elec. Trams Monte Video	5	7	6†	5¾ — 6¼	..	5 13 0
Do. 6 % Pref.	5	6	6	5 — 5½	..	4 10 11
Do. 5 % 1st Deb.	100	5	5	102 —105	+1	4 15 3
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	105½ —107½	..	4 3 9

MANUFACTURING COMPANIES.

Aron, Ord.	1	..	..	3/32 — 5/32	— 1/32	..
Do. 6 % Pref.	1	12	9	3/32 — 5/32	..	6 17 11
Babcock & Wilcox	1	24	20†	5⅜ — 5⅝	..	4 5 4
Do. Pref.	1	6	6	1⅜ — 1½	..	4 0 0
B.I. & Helsby Cables	5	10	10	6¾ — 7⅛	..	6 15 7
Do. Pref.	5	6	6	6 — 6⅛	..	4 12 4
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	96 — 99	..	4 10 11
British Westinghouse, Pref.	3	Nil	Nil	⅜ — ½	..	Nil
Do. Deb.	100	4	4	61 — 64	..	6 5 0
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	Nil	Nil	3/32 — 1/16	..	Nil
Do. Pref.	1	Nil	Nil	14/6—15/6	..	Nil
Brush, Ord.	2	Nil	Nil	3/32 — 1/8	..	Nil
Do. 7 % Pref.	2	Nil	Nil	⅛ — ⅜	..	Nil
Do. 4½ % Deb.	100	4½	4½	59 — 64	..	7 0 8
Do. 4½ % Second Deb.	100	4½	4½	41 — 46	..	9 15 7
Callender's Cable	5	15	10†	9⅜ — 9⅝	..	7 13 5
Do. Pref.	5	5	5	4⅝ — 5⅛	..	4 17 7
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
Castner-Kellner	1	17½	7½†	3⅛ — 3⅜	..	4 19 2
Do. Deb.	100	4½	4½	103 —106	..	4 4 11
Crompton & Co.	3	Nil	Nil	⅛ — ⅜	..	Nil
Do. Deb.	100	5	5	60 — 70	—10	7 2 10
Dick, Kerr	1	5	6	1⅜ — 1⅝	— 1/16	6 8 0
Do. Pref.	1	6	6	1 — 1⅛	..	5 6 8
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Edison & Swan, A, £3 paid	5	Nil	Nil	1/16 — 1/8	+ 1/16	Nil
Do. fully paid	5	Nil	Nil	1⅛ — 2⅜	+ 1/16	Nil
Do. 4 % Deb.	100	4	4	69 — 73	..	5 9 7
Do. 5 % Second Deb.	100	5	5	78 — 81	..	6 3 5
Electric Construction	2	Nil	Nil	¾ — 1	..	Nil
Do. Pref.	2	7	7	1¾ — 2	..	7 0 0
Greenwood & Batley, Pref.	10	7	7	10½ — 10⅝	..	6 10 8
Do. Deb.	100	5	5	102 —102½	..	4 16 7
General Electric, Pref.	10	5	5	8¾ — 9⅛	..	5 8 1
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	5	15	15	12⅜ — 12⅞	..	5 16 6
Do. Pref.	5	4½	4½	4⅞ — 5⅛	— 1/16	4 7 10
Do. Deb.	100	4½	4½	106 —108 xd	..	4 3 4
India-Rubber, G. & T.	10	10	10	15⅜ — 16⅛	— ¼	6 1 3
Do. Pref.	10	5	5	10⅜ — 10⅝	..	4 13 0
Telegraph Construction	12	17½	20	36½ — 38½	..	6 5 0
Do. Deb.	100	4	4	100 —102	..	3 18 5
Willans & Robinson	1	Nil	Nil	⅛ — ⅜	..	Nil
Do. Pref.	5	3	Nil	⅜ — 1	..	Nil
Do. Deb.	100	4	4	55 — 65	..	6 3 1

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 3 per cent., March 9th, 1911.

NOTES ON ELECTRIC STREET LIGHTING.

BY L. CROUCH.

(*Continued from page* 940.)

3. *Metallic-Filament Lamps.*—As at present constructed and in the high C.P. units employed in street lighting, metallic-filament lamps are fairly robust, and are becoming less dependent on a vertical position as the condition for long life. It is shown in Table I that metallic-filament lamps compare very favourably with Nernst lamps as regards prime cost; renewals are more costly than Nernst glowers, but the average life of metallic-filament lamps is well over 1,000 hours, and there are many authentic instances in which a mean life of over 2,000 hours* has been obtained. The attendance charges for metallic-filament lamps are negligible; they have solely to cover a periodical inspection and a cleaning of the "lantern" globe or panes. Neglect of the latter duty is frequently the cause of much inefficiency.

The light emitted by metallic-filament lamps is not so white as that of Nernst or arc lamps, nor is it so rich in red rays as that obtained from carbon-filament lamps. The light from the latter is objectionably red in character (in these days when the available illuminants are so numerous and diverse as to permit such fastidious criticism); "metallised" carbon filaments give a somewhat whiter light, while metallic filaments emit a still more uniform spectrum. None of the filament lamps at present in commercial use have so red a light as the whitest oil-flames (which point is of considerable practical importance in photometric work).

The now well-known phenomenon of "overshooting" peculiar to metallic filaments (or in general to materials having a positive temperature coefficient of resistance) does not appear likely to lead to any practical difficulties, owing to its extremely short duration. Tungsten filaments overshoot most strongly, and during the first $\frac{1}{100}$ to $\frac{1}{30}$ sec. after switching such a lamp into circuit the current rises to eight or ten times its steady value (according to oscillograph tests).

The constancy of C.P. of metallic-filament lamps is higher than that of carbon-filament types. Tantalum lamps blacken on the vertical sides of the bulb, the M.H.C.P. being hence reduced more than is the M.S.C.P. (see "reduction factor" notes); tungsten lamps do not appreciably blacken as usually built, though unsuitable jointing materials and methods (applied to the filament leading-in-wire joint) have occasionally caused more or less serious local "blackening" of the bulb. For rough purposes, the following decadences of efficiency and candle-power may be taken as representative:—

TABLE V.—DECADENCE OF CANDLE-POWER.

Type of lamp.	Mean life, hours.	Mean efficiency. Watts/C.P.	Fall in C.P. during life.	Increase in energy consumption during life
			%	%
Carbon	700—1,000	3·0—4·0	30	20—25
Metallised carbon...	700—1,000	2·5—2·8	20	20
Osmium	2,000	1·4—1·7	10—20	15
Tantalum D.C. ...	1,000	1·7	20 (30 if bad)	20
,, A.C. ...	500—1,000	2·1	20—30	60
Tungsten	1,500—2,000	1·2—1·4	5—6	18

The colloidal and drawn-wire tungsten lamps (represented by the "Brimsdown" and "Mazda" lamps respectively) are a great advance on earlier types employing incandescent tungsten, both as regards mechanical strength and efficiency (the latter now closely approaching 1 watt per C.P.)†

4. *Carbon-Filament Lamps* are mechanically stronger than the metallic-filament types, and no objections can be raised on this score against their use in street lighting. Their first cost is low (Table I), their life varies from 800-1,000 hours under favourable conditions, and their attendance charges are negligible. Their distribution curve, colour, intrinsic brightness of source and C.P. of units are all satisfactory, while their "ageing" is not prohibitive (see Table V). The sole and vital objection to the continued use of carbon-filament lamps for street lighting is their low electrical efficiency (Table II). In this respect metallic-filament lamps are vastly superior, and are hence assuming predominance in spite of their high prime cost (Table I).

Illumination required in Street Lighting.—Before detailing what are usually considered reasonable values for street illumination under various conditions, it may be well to state the value of certain familiar illuminations in the same units so as to enable a more accurate appreciation of the former results. Such "natural" illuminations are:—

Night sky light: no moon, 0·001 candle-feet... } Lewinson,
Average moonlight, 0·014 candle-feet ... } New York
Brightest moonshine: clear air, 0.1-0·16 candle-ft. Hoppe
Daylight, 8 a.m.-4 p.m., 2,000-8,000 candle-ft. Lewinson

In street illumination it is desirable, though not essential, to mention the *mean* illumination required or effected. What are of more importance, however, are the maximum and minimum illuminations obtained.* The maximum illumination is usually attained at some distance from the foot of the lamp pillar when vertical carbon arcs are employed (these usually give maximum C.P. at 40°—45° with the vertical); with flame arcs the maximum illumination is vertically below the lamp (unless dioptric globes are used—see above). The minimum illumination occurs midway between adjacent poles, if these are similarly equipped. In Table VI are summarised particulars of the recommendations made by various authorities concerning the desirable illumination in streets, and certain data concerning Berlin and Paris streets. From this information the average results of Table VII at once follow:—

The ratio of the maximum to the minimum illumination falls as low as 5 in certain of the main Berlin streets, where flame-arc installations of the latest type are to be found.

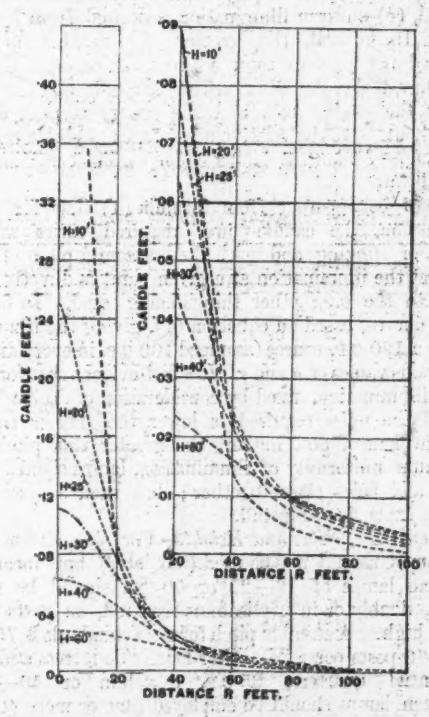


FIG. 5.—SEE NOTES TO TABLES VIII AND IX.

This remarkably uniform illumination is attained by the use of high candle-power units slung at a great height; the inclined carbons of flame arcs further aid uniformity of illumination. Flame arcs hung at a height of 25 to 30 ft. give a more uniform illumination than is obtainable by H.P. "incandescent" gas. The above uniformity is exceptional; even in main streets the maximum illumination is

* The average life of 75 m.f. street lamps at Hammersmith was 3,600 hours.

† For a useful summary of the methods of metallic-filament manufacture the reader may refer to the *Illuminating Engineer*, January, 1911, pages 23-26.

* The reader will find much information concerning the importance, uses, and values of the ratio max./min. illumination in Mr. Harrison's paper (*loc. cit.*).

TABLE VI.—ILLUMINATION DESIRABLE IN STREETS.

Authority or place.	Minimum.		Maximum.		Mean.	
	Candle-feet.	Lux.	Candle-feet.	Lux.	Candle-feet.	Lux.
Voysey: Report on City of London lighting	0·10	1·18	(Four feet above street)		—	—
Wagoner—for small towns	0·024	0·28	—	—	—	—
Hoppe—general from	0·0085	0·10	—	—	—	—
to (for fairly busy streets)...	0·085—0·17	1—2	—	—	—	—
ACTUAL CASES:—Average Paris streets	—	—	—	—	0·0425—0·29	0·5—3·4
Königgratzen Str. } Bloch, {	0·16	1·88	8·4	99·0	1·53	18
Potsdamer Str. } Berlin. {	0·24	2·83	11·4	134·0	1·53	18
Friedrichstrasse } {	0·45	5·29	3·3	38·8	—	—

For heavy traffic a mean illumination of 0·14 candle-foot (1·65 lux) is insufficient; 1·7 candle-feet (20 lux) is a good allowance for arc lighted main streets.

TABLE VII.—AVERAGE ILLUMINATION ALLOWANCES.

	Minimum.		Maximum.		Mean.	
	Candle-feet.	Lux.	Candle-feet.	Lux.	Candle-feet.	Lux.
Smallest side streets ...	0·0085	0·1	0·85—1·28	10—15	0·13—·26 or ·34	1·5—3 or 4
Fairly busy streets... ...	0·128	1·5	4·25	50	0·425—0·85	5—10
Main streets	0·170—0·255	2—3	8·5—12·8	100—150	1·70	20

very frequently 50 × the minimum, without undue contrast or inconvenience ensuing. In some installations the ratio rises to 100 or 150; such cannot be regarded as satisfactory. The use of dioptric globes and improved reflector shapes has recently led to great improvements in this respect.

Candle-Power of Units.—The question of the C.P. of the illuminating units to be employed is involved with the illumination desired and the characteristics of the type of lamp employed. Broadly speaking, *high candle-power units* should be used when (*a*) high illumination is desired, (*b*) very uniform illumination is required, and this can be provided by high C.P. units on high standards; *low candle-power units* should be employed when (*a*) low illumination is required, (*b*) uniform illumination is desired from low-slung lamps. In general, the greater the number of lamps employed per post to total a given C.P. on each, the more uniform will be the illumination effected, but the higher will be the capital cost and the energy consumption per candle-hour. Of the relative advantages of single arc lamps and groups of filament lamps under various conditions more is said below.

It will be apparent from formula (1) that for a given illumination, the candle-power required varies with the height of slinging and with the horizontal pitch of lamps: also that the illumination at a given point is directly proportional to the C.P., other things being equal. In fig. 5 are shown curves, based on equation (1), giving the illumination due to a 100 C.P. source (assumed 100 C.P. in every direction) for various values of h and r. It is self-evident that for a given mean illumination, fixed by consideration of Table VII, the C.P. of the units required is lower the shorter the pitch between lamps, and higher, the greater this pitch. For maximum uniformity of illumination, lamps should be high slung and poles close together; but such a system is, of course, expensive to install.

Usual C.P., Pitch and Height.—For side street lighting arc lamps should not be used (see later) but incandescent filament lamps of 16—25 or 50-C.P. should be mounted singly, doubly or in triplicate as required, on posts 9, 12 or 15 ft. high. A suitable pitch for such standards is 75—90 ft. (60—70 posts per mile). For large side streets and average residential quarters, 25-C.P. tantalum or 50—100-C.P. tungsten lamps should be employed (one or more per post as necessary). The 50-C.P. tungsten lamp has met a very considerable demand for street lighting purposes, while higher candle-power units of the same type are equally satisfactory where more light is required. The 100—400-C.P. series of high-voltage tungsten lamps (100—260 volts), being now on a commercial basis, practically eliminates the small open or enclosed arc from competition in street lighting. No arc lamps should now be employed unless 600—1,000-C.P. units can be usefully installed.* Nernst lamps have been used, in 66, 300 and 800-C.P. units for street lighting, but will probably soon be completely superseded by metallic-filament lamps which, to the writer's knowledge, have already replaced them in numerous provincial towns. For side street lighting and for lighting the main streets of small towns metallic-filament lamps should be used in 50—400-C.P. groups; in the case of the lower C.P. lamps, from 1 to 5 or 6 are used per post according to needs. If the total C.P. per post needs to exceed 500—600 C.P. the advisability of installing arcs must be very carefully examined. The pitch and height of suspension of the higher C.P. lamps (filament type) vary from 75—120 ft. and from 12—25 ft. respectively.

For street widths of from 30—100 ft. and where fairly high illuminatian is desired, 8—10 amp. D.C. or A.C. arcs form the commonest units. The 10-amp. size is the smallest which should be adopted as a rule; this has a mean lower hemispherical C.P. of about 1,000 C.P. Flame arcs cannot be profitably employed for units of less than 1,000 C.P. (6 amps.) or preferably 2,000 C.P. (10 amps.). As a fairly accurate rule it may be taken that, properly installed—

Flame arcs yield 170—200 M.H.-S.C.P. per ampere.

Ordinary open and enclosed arcs yield 100 M.H.-S.C.P. per ampere; (D.C. and A.C. in both cases).

The pitch of 1,000-C.P. arc lamps varies from 80 to 140 ft. in cases where a high mean illumination is desired, as in the main thoroughfares of cities, up to 200—250 ft. in smaller or less frequented streets.

The higher an arc lamp is hung, the more uniform, though of course the less intense, is the ground illumination effected by a given candle-power; 10-amp. arcs should never be hung lower than 20 ft., or the rays directly entering the eyes of pedestrians, horses, &c., will produce the annoying, and possibly dangerous, dazzling already referred to.

In exceptional cases, such as the lighting of station yards, sidings, &c., arc lamps are hung as high as 100—150 ft., but a more general range is from 25 or 30 ft. up to 50 or 60 ft. In towns it is usually inconvenient to suspend lamps higher than 40—45 ft., while in many city installations 18—20 ft. is the standard height of suspension. For the reasons already given, this is lower than is desirable or efficient from the illuminating engineering point of view.

For average towns, a pitch of 160 ft. for 10-amp. arcs and 120 ft. for 7½-amp. arcs gives reasonably good and uniform illumination if, at the same time, the lamps are high slung (say 30—35 ft.). Where centre arc standards are used, it is common to place the posts some 20 per cent. closer together than where side posts are employed; the lamps are 10—15 per cent. higher in the former case. A more uniform illumination is thus obtained. Centre posts are only permissible in fairly wide streets, on account of the obstruction they otherwise offer to traffic; apart from the wider street making a higher pole desirable, the centre-hung lamp can frequently be placed higher than

* In some cases (*e.g.* shop lighting) efficiency of illumination is not the guiding factor in the choice of a type of lamp; the above remarks do not then apply

TABLE VIII.—CANDLE-POWER, PITCH, HEIGHT AND ILLUMINATION—ORDINARY ARCS.

Candle-power ...	500			600			700			800			900			1,000		
Height—feet ...	20	33	46	20	33	46	20	33	46	20	33	46	20	33	46	20	33	46
Minimum candle-feet.	Distance between two lamps—in feet.																	
0·043	144	164	178	154	178	190	164	188	204	171	197	220	178	210	223	184	214	233
0·085	112	125	128	122	135	141	128	144	151	135	151	161	141	158	170	144	164	178
0·170	85·5	92	85·5	92	98·5	98·5	98·5	108	105	105	115	115	102	118	122	112	125	128

TABLE IX.—CANDLE-POWER, PITCH, HEIGHT AND ILLUMINATION—FLAME ARCS.

Candle-power	1,200			1,500			2,000			2,500		
Height—feet	30	45	60	30	45	60	30	45	60	30	45	60
Min. illum.—candle-feet.	Distance between two lamps—in feet.											
0·15	72	77·5	78	79	85	88	88	96	100	95	105	111
0·30	54	55	50	60	62	59	67	71	71	73	79	80
0·50	43	40	28	48	46	38	54	55	50	60	62	59

would be possible on the side path on account of overhanging trees on the latter.

A useful summary of the above remarks is :—

	Streets requiring minm. illumination for which arcs would be used.		Average streets.		Specially well-lighted streets.	
	Pitch.	Height.	Pitch.	Height.	Pitch.	Height.
	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.
Side lighting ...	300	20	160	25—30	100	30—42½
Centre lighting...	240	23—27	130	30—35	80	35—50

The determination of the most economical pitch of lamp pillars is a matter of considerable importance, since on the number of poles per mile largely depends the capital cost of lamps and poles, and the subsequent trimming, attendance and repairs costs.

A useful set of data, covering the range of conditions probable in practice, is contained in Tables VIII and IX, based on equation (1). The three standard minimum illuminations assumed in Table VIII are such as would be probable in the side streets of small towns, fairly frequented streets and the main thoroughfares of large towns respectively. Table IX gives a similar set of data based on the conditions probable in modern flame-arc installations ; suitably higher C.P. units are assumed, and the minimum illuminations taken as bases are such as would be specified in the three most important grades of thoroughfares in the largest cities.

A curious point, which may be noted in Table VIII, and still more so in Table IX, is that on slinging a lamp of given candle-power higher and higher, the pitch, lamp to lamp, required to produce a given minimum illumination, at first increases and then decreases. In every case of such raising of the lamps there are at work two opposing influences, but it is not in every example that the critical case, in which these exactly counterbalance each other, is passed through.

As the lamp rises, its rays fall more perpendicularly on the point of minimum illumination, hence the reducing factor ($\sin \alpha$ in $I = C P/h^2 \sin^3 \alpha$) approaches unity. On the other hand, the intensity of illumination falls in accordance with the law of inverse squares as the lamp rises. These opposing tendencies lead to the above-mentioned critical point. In some of the cases of Table IX, the influence, decreasing the illumination midway between the lamps as the latter rise, is entirely preponderant.

(To be continued.)

GLOBES, SHADES AND REFLECTORS.

BY C. TOONE.

GLOBES, shades and reflectors serve two important ends in illuminating engineering—(*a*) They protect the eye from direct vision of sources of too great a luminous intensity. (*b*) They distribute the light emitted by the source in any desired manner—uniform or otherwise.

How necessary these accessories are is witnessed daily by the many instances in which they are neglected or improperly utilised. In shop window lighting one see lamps dazzling the eyes of prospective customers, or by hanging unscreened over the pavement, causing discomfort to passers-by, and even danger to the faster moving users of the road ; in churches, low-placed concentrated lights impede the view of the pulpit and stand in painful contrast to the gloom which envelops the upper portions of the building ; in lecture and concert halls similarly misplaced and deficiently protected lights make it difficult to see the speaker or performer, while, in domestic lighting of every kind, ill-screened lights too often ruin the efficacy of an elaborate scheme of illumination, besides inflicting serious injury on the eyes of persons using the rooms ; finally, in streets and open spaces, all manner of inferior protecting and distributing devices are assembled round lamps, whose excellence in other respects is thereby heavily discounted.

It should in this country, as in America, be widely recognised that a globe is an essential accessory to every lamp, and one, moreover, which should be designed to meet the special characteristics of the lamp and the requirements of the service concerned.

Permissible Brightness of Luminous Sources : Actual Intrinsic Brilliancies.—It is one of the first principles in the creed of illuminating engineering that hygienic and physiological requirements should first be fulfilled, æsthetic and other needs being then satisfied as far as possible. Now the physiological effect of luminous radiations depends rather upon the *intensity* or *intrinsic brilliancy* of the source than upon the total luminous flux emitted, hence it is necessary to consider carefully what is the permissible maximum luminous intensity which may come within the direct field of vision without involving any abnormal eye fatigue. On this point there exists a great divergency of opinion : 30 C.P. per sq. in. (circa 5 C.P. per sq. cm.) is doubtless too high a brilliancy to be continually in the field of view, indeed from 1 to 5 C.P. per sq. in. (0·16 to 0·78 C.P. per sq. cm.) seems to be an

TABLE I.—INTRINSIC BRILLIANCIES (1 sq. in. = 6·45 sq. cm. ; 1 sq. cm. = 0·155 sq. in.).

Source.	Intrinsic brilliancy.		Ratio of actual to permissible brilliancy, taking the latter to be—				Authority (Cols. 2 and 3).
	c.p. per sq. in.	c.p. per sq. cm.	5 c.p.	1 c.p.	0·1 c.p.	0·05 c.p.	
Sun (at zenith)	600,000	93,000	120,000	600,000	6,000,000	12,000,000	Thompson
Sky (mean)	4	0·62	0·8	4	40	80	Darch
" "	2 to 5	0·31 to 0·78	0·4 to 1·0	2 to 5	20 to 50	40 to 100	Darch
" "	2½	0·39	0·5	2·5	25	50	Basquin
Reflection, walls and ceilings	0·0001 to 0·01	0·00001 55 to 0·00155	·00002 to ·002	·0001 to ·01	·001 to ·1	·002 to ·2	Darch
Candle flame	3	0·47	0·6	3	30	60	Thompson, Darch
Petroleum lamp...	213	33	43	213	2,130	4,260	Stockhausen
8-in. Japanese lantern	0·01	0·00155	0·002	·01	·1	·2	Darch
8-in. opal globe containing 16-c.p. filament lamp	0·2	0·031	0·04	·2	2	4	
Ordinary gas mantle	20 to 25	3·1 to 3·9	4 to 5	20 to 25	200 to 250	400 to 500	Thompson
" "	25	3·9	5	25	250	500	Darch
" "	34·2	5·3	6·8	34·2	342	684	Stockhausen
High-pressure gas mantle	162	25	32·4	162	1,620	3,240	Morris
Carbon-filament lamps	103	16	20·6	103	1,030	2,060	Morris
" "	290 to 580	45 to 90	58 to 116	290 to 580	2,900 to 5,800	5,800 to 11,600	Solomon
Carbon-filament lamps	425	66	85	425	4,250	8,500	Stockhausen
" " "	450	70	90	450	4,500	9,000	Darch
Nernst lamps	1,420 to 3,060	220 to 475	284 to 612	1,420 to 3,060	14,200 to 30,600	28,400 to 61,200	Solomon
" "	2,580	400	516	2,580	258,000	51,600	Stockhausen
Metallic-filament lamps	1,000	155	200	1,000	10,000	20,000	Darch
" " "	1,150	178	230	1,150	11,500	23,000	Stockhausen
Osmium lamps	710	110	142	710	7,100	14,200	
Tantalum "	900	140	180	900	9,000	18,000	Solomon
Tungsten "	1,410	218	282	1,410	14,100	28,200	
" "	970	150	194	970	9,700	19,400	Morris
" "	1,000	155	200	1,000	10,000	20,000	Thompson
Mercury lamp (low volts)	2·6 to 3·9	0·4 to 0·6	0·5 to 0·8	2·6 to 3·9	26 to 39	52 to 78	Solomon
Moore tube	3·2 to 4·5	0·5 to 0·7	0·6 to 0·9	3·2 to 4·5	32 to 45	64 to 90	
Carbon arc	19,400	3,000	3,880	19,400	194,000	388,000	Stockhausen
" "	20,000	3,100	4,000	20,000	200,000	400,000	Darch
" "	103,500	16,000	20,700	103,500	10,350,000	20,700,000	Morris
Flaming arc *	5,000	776	1,000	5,000	50,000	100,000	Thompson
10-in. frosted globe containing flame arc	19·4	3	4·0	19·4	194	388	Morris

* The source is now actually the *arc* which has a much greater surface (and, therefore, a proportionately lower brilliancy) than the crater of a carbon arc.

extreme upper limit, and while L. Bell suggests 5 c.p. per sq. in. (0·78 c.p. per sq. cm.) as a limiting brilliancy :—

Stockhausen suggests 4 c.p. per sq. in. (0·62 c.p. per sq. cm.)
Broca suggests 1·3 c.p. per sq. in. (0·20 c.p. per sq. cm.)
Woodwell (U.S.A.) suggests 0·2—0·1 c.p. per sq. in. (0·03—0·016 c.p. per sq. cm.)
Marks suggests 0·1 c.p. per sq. in. (0·016 c.p. per sq. cm.)
} as a limiting brilliancy.

Darch suggests 0·05 c.p. per sq. in. (0·0078 c.p. per sq. cm.), for continuous work, and 0·10 c.p. per sq. in. (0·016 c.p. per sq. cm.), for short periods.

Reconciliation between such diverse figures is clearly impossible ; probably the earlier values are much too high, the desirable maximum intrinsic brilliancy (exposed to the eye) being as far below ½ c.p. per sq. in. as it is possible to secure conveniently.

Compare, now, these widely different, but all low, brilliancies with the actual intrinsic brilliancies of various sources (Table I), and the necessity for screening and the magnitude of the reduction to be effected in the case of all the commonly employed illuminants of to-day, will be at once apparent.

While we can hardly approach the perfect diffusion of daylight, by which the enormous intrinsic brilliancy of the sun (some 90,000 c.p. per sq. cm.) is reduced to about 0·4 c.p. per sq. cm. for ordinary skylight, we must effect as uniform distribution and diffusion as possible, remembering that the avoidance of contrast and sudden variations of brilliancy is a matter of even greater importance than further reduction of intensity, once the latter falls below 3—5 c.p. per sq. cm.

It might reasonably be considered that an intensity equal to that of average skylight would be a suitable limiting brightness for any exposed source within the field of view, but—

(*a*) Skylight is intolerably bright to most eyes (unless from parts of the "dome" near the horizon whence, of course, light is received through a greatly increased thickness of air).

(*b*) Our eyes assume a considerably more sensitive state under artificial light than they possess in daylight.

— hence an intensity by night, equal to that of skylight by day, is doubly unpermissible.

The chief effects of viewing too intense sources of illumination (whether primary sources or secondary sources—surfaces of reflection), are to fatigue the eye by too severe retinal excitation, to lose a portion of the inherent sensitivity of the retina and, by causing excessive pupillary contraction, to render unrecognisable less brilliant objects in the field of view. Some recent valuable researches, by Dr. Broca, showed that the diameter of a normal "pupil," receiving a uniform and "permissible" illumination (at night) = 12 mm., but, when viewing an incandescent filament, flame or mantle, this diameter decreased to about 8 mm., further falling to 5 or 6 mm. when gazing at a naked arc crater : in the latter instances the quantity of the light entering the eye and producing a retinal image was only 0·40 and 0·23 respectively of that which entered under the "normal" conditions.

Desirable Illumination in Various Services.—It will be found convenient in designing any globe or reflector system to have easy access to summarised data concerning the illumination generally found suitable for the purposes in view ; hence, though such information might, at first sight, appear irrelevant to the subject of the present article, the figures of Table II are presented at this point.

This data requires no comment beyond a further emphasis of the fact that, since successful illuminating engineering combines the provision of sufficient light, distributed in a suitable manner, with the minimum possible cost of operation, it is worth while going to considerable trouble to obtain *complete data* concerning a large number of actual installations in order that the design of future schemes may be facilitated, errors and sources of inefficiency avoided and satisfactory features imitated.

Coefficients of Direct and Diffuse Reflection.—As being requisite in the design of reflectors and in the later consideration of multiple reflection, the effect of surroundings on diffusion and so on, the data of Tables III and IV are introduced showing respectively the coefficients of "direct"

(ray for ray) and "diffuse" (scattered) reflection for various materials.

TABLE II.—Illumination in Various Services.

(1 foot-candle = 10 lux = 10 metre-candles.)

Service.	Illumination. Foot-candles.	Lux.	Authority.
General	0·5—1·0	5— 10	Broca.
Fine work plus local	0·8—1·0	8— 10	—
" " (minimum)	2·5	25	Terrien.
" " (average)	5 —10	50—100	Barrows.
Drawing office	5 — 6	50— 60	Eck.
Ordinary (commercial) office ...	2 — 5	20— 50	Barrows.
Reading (good illumination) ...	3 — 4	30— 40	Broca.
(sufficient)	1	10	Morris.
(minimum)	1	10	Broca.
Shops and showrooms	4 — 4½	40— 45	Eck.
Display of dark goods	5 —10	50—100	Barrows.
Shops (general)	2 — 5	20— 50	Barrows.
Printing works	4 — 5	40— 50	Eck.
Engineering, machine shops ...	3 — 4½	30— 45	Eck.
Textile mills from	1½— 2	15— 20	—
to	2½— 4	25— 40	—
Libraries—General	1 — 2	10— 20	Barrows.
Local	3 — 4	30— 40	—
General (3 ft. from floor) ...	1	10	—
On tables from ...	2½—10	25—100	—
mean ...	5	50	—
Bookshelves—vertical ...	1½— 4	15— 40	Marks.
horizontal ...	4 — 8	40— 80	—
Lecture and concert rooms ...	2 — 4	20— 40	—
Theatres...	1 — 3	10— 30	—
Churches...	2 — 4	20— 40	—
Ballrooms, &c.	2 — 3	20— 30	—
Domestic...	1 — 2	10— 20	—
Corridors, &c, ...	½— 1½	5— 15	Barrows.
Postal service (sorting, &c.) ...	2 — 4	20— 40	—
Paris G.P.O.	1½— 2	15— 20	Broca.
Interiors, average (minimum)	1 — 1½	10— 15	Terrien.
Bright illumination	4	40	General convention.
Medium "	1 — 3	10— 30	
Dim "	½	5	
Equivalent to daylight ...	5	50	Eck.
" " ¾ "	1	10	
(for reading) ...			
Ordinary small print just legible	0·2	2	
Underground railway cars (London)	1 — 2	10— 20	Morris.
Important public spaces ...	½— 1½	5— 15	Barrows.
Streets (minimum)	0·1	1	Broca.
Gas lighting	0·05—0·25	0·5 —2·5	Barrows.
Electric "	0·05—0·60	0·5 —6·0	—
Moonlight (full moon)... ...	0·025-0·030	0·25—0·3	Barrows.

TABLE III.—Coefficients of Direct Reflection (Average)

Material (highly polished).	Per cent. (single reflection).
Silver	92
Mirrors—surface silvered	70-85
silver-backed glass	80
speculum metal	70
Brass	72
Copper	65
Steel	60
Gold	52
"Totally" reflecting prisms*	90 (or more)

* The loss being wholly by absorption in the glass of the prism, no loss can occur at the reflecting face if plane.

TABLE IV.—Coefficients of Diffuse Reflection (Average)

	Per cent. (single reflection).
Paper:—	
White blotting and cartridge	80—85
Ordinary white	70
Tissue	50
Light, buff or yellow...	40—60
Light pink	35
Tracing	25
Dark colours	10—20
Deepest colours or black	3—5
Fabrics:—	
Black cloth*	1—1½
" velvet (about)*	½

* Few "blacks" are totally absorbent, and the great superiority of velvet in this respect is due to the repeated reflection (and hence rapid absorption) which occurs in its deep "pile."

	Per cent. (single reflection).
Paints:—	
Light colours, clean	40—60
" " dirty	20—30
Dark colours	10—20
Deepest colours (about)	5
Miscellaneous:—	
Whitewashed ceilings	50—70
White enamelled reflectors	70—80
Glass, clear	5—10
" opal	10—30
Wood and Cardboard:—	
Freshly planed "white" wood	40—50
Dirty "white" wood	20
Commercial cardboards, various colours	20—30

From the results shown in Table IV, stress may at once be laid upon the great importance of keeping all reflecting surfaces (whether of the "primary" reflector or of such "secondary" reflectors as wall paper, ceilings, &c.) as clean as possible; further detailed remarks are made later on this point.

(To be continued.)

A NEW SYSTEM OF TELEPHOTY.*

As the result of a long series of experiments at the Institute of Technology at St. Petersburg, Prof. Rosing has lately developed a new system of telephoty which seems to bring us much nearer the practical solution of the problem.

The reproduction of the picture transmitted—which, of course, constitutes the chief difficulty of the problem—is effected by an application of the properties of the cathode tube. At any given moment during the operation of the apparatus, the cathode stream in a Braun tube at the receiving station is focused on, and causes fluorescence of, a point on the receiving screen exactly corresponding to the point on the picture then dealt with by the transmitting apparatus. Unlike most earlier experimenters, Rosing does not employ a selenium cell to record and control (in reproduction) the varying luminous intensity, or optical density, of the original picture. Instead, he uses a specially rapid photo-electric cell consisting essentially of a glass bulb containing rarefied hydrogen or helium and sodium, potassium, caesium or rubidium amalgam. The amalgam constitutes the optically sensitive electrode, while for the anode a platinum electrode is fused through the bulb. The amalgam being negatively charged and illuminated, there occurs, by the Hallwachs effect, a discharge from its surface, varying in strength directly in proportion to the intensity of the incident illumination (Righi and Stoleton). Moreover, this photo-electric current accurately follows the variations in the exciting illumination.

Referring to fig. 1, which shows the essential features of the sending and receiving stations, it will be seen that six interconnecting wires are necessary in the arrangement represented; it is possible, however, to reduce the number to four. An image of the real object or picture M N to be transmitted is thrown on to an opaque screen M' N' by the combined action of the lens L and the

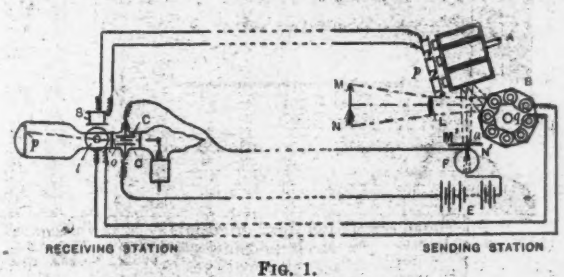


FIG. 1.

polygonal mirrors A B. The axes of A B are perpendicular to each other, hence the image M' N' suffers displacement in two perpendicular planes—perpendicular to the plane of the drawing by the rotation of A and in the plane of the drawing by the rotation of B. It follows that by rotating B more slowly than A the image of M N is given a zig-zag movement over the transmitting screen, and every point in turn comes over an aperture *a* in M' N' and is thus projected through on to the gas cell P.

At the receiving station, two electromagnets *s t* are placed perpendicular to each other round the cathode-ray tube, so that the resultant point of impact *p* of the cathode stream is at every moment similarly disposed on the receiving screen to the point of the transmitted picture then over *a* at the sending station.

* Abstract from article by E. Ruhmer in *Zeit. für Schwachstromtechnik*, April, 1911.

That this may be so, S is connected to coils p_1, arranged round the axis of A as shown, and t to coils q similarly placed round B. In the windings p_1 q currents are induced by the passage past them of electromagnets placed on the rims of the mirror frames as shown. The strength of these currents is proportional to the speed of the mirrors at every moment, and the same law therefore controls the strengths of the fields of s t. Also the point over a (sending) and the point p (receiving) move according to the same law; in fact, the cathode stream and therefore the luminous spot on the receiving screen, moves synchronously and isochronously with the motion of M′ N′ over a.

To reproduce the relative brightness of various parts of M′ N′, electrostatic control of the cathode stream is also exercised. Condenser plates C C are fused into the Braun tube and are connected respectively to the positive terminal of the battery E and to the platinum electrode of F. The light sensitive electrode of the latter is connected to the negative pole of E. Then, according to the brightness of the various points of the image M′ N′ successively coming over a, the condenser C C is weakly or strongly charged (and in direct proportion to the intensity of the light incident on F). Under the influence of the electrostatic field thus set up between C C, the cathode stream is deflected downwards (in the plane of the paper), more or less of the stream then passing through an aperture in the diaphragm o, which, when C C is uncharged, completely cuts off the rays from the receiving screen.

On first commencing work, a slight phase displacement may exist between the diversion and modulation of the cathode stream, but this may be at once corrected by rotating the coil systems p_1, q through a few degrees round the axes of A, B.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

E.A.C. Starter for S.P. Induction Motors.

THE ELECTRICAL APPARATUS CO., LTD., now installed in their new "Vauxhall works" in South Lambeth Road, S.W., have brought out a new type of starter for single-phase induction motors, of which an illustration is given herewith. The switch is operated by one handle, moving in one direction only, which cannot be left in the starting position, and all the parts are under one cover. If the motor does not start on the first step, the movement of the handle to the right will progressively increase the torque up to the maximum that the motor is capable of developing; this result is attained by using both resistance and a choking coil in the stator circuits, and resistance in the rotor circuit in the case of a slip-ring rotor.

The use of the stator resistance allows the rotor resistances to have comparatively low values, so that they and the choking coil can be mutually designed to the very best advantage. This is a great gain over the common method of providing a fixed stator resistance, if any, and gradually cutting out the rotor resistance, since in that case the effect of the auxiliary phase becomes less and less, neutralising the increase of effect of the main phase.

FIG. 1.—OPEN-TYPE E.A.C. STARTER FOR S.P. INDUCTION MOTOR.

The mode of operation is, that a single lever carries two brushes: one of these supplies current to the running phase, gradually cutting out resistance, while the other energises the starting phase through a choking coil: this phase is automatically opened, when the handle nears the full running position, by means of a quick-break knife switch linked to the main handle. In the case of squirrel-cage motors, this comprises the whole of the operations to be performed.

For the slip-ring type, three brushes are provided, which short-circuit the rotor resistances in one step in the final position of the handle. Carbon make is provided for all motors over 5 H.P. No-voltage and overload releases can be provided, or press-button spring release. The starters are made in various sizes up to 50 H.P.

The illustration, fig. 1, depicts a starter of the open type—they can, however, also be supplied semi or totally enclosed.

Low-Frequency Arc Lamp.

In order to overcome the difficulty of obtaining satisfactory burning on power circuits of low frequency, such as 25 cycles, the FOSTER ENGINEERING CO., LTD., of Morden Road, Wimbledon, S.W., have brought out a special enclosed arc lamp for this purpose, on their hot-wire principle, in which no dashpot or solenoid is employed, and the construction is extremely simple. These lamps burn singly on 100 to 120 volts, or two in series on a compensating transformer on 200 to 250 volts, taking 4½ to 8 amperes, and burning for 40 or 50 hours. The Foster hot-wire lamp is largely used by the Post Office on A.C. circuits.

Electric Controllers.

MESSRS. ALLEN, WEST & CO., LTD., of Lewes Road, Brighton, who specialise in electric controllers, have introduced a number of improvements into their standard designs. Their double D.C. crane controller with universal gear is shown in fig. 2, with one of the arc shields swung back; the frame of these controllers is of cast-iron, and the gearing is bolted directly to it and not to the top cover. Special provision is made to facilitate the wiring of the controller, and the introduction of the cables into the case. The front cover is readily removable, and all parts are easily accessible for renewal or repair. The drum is constructed of castings on a steel shaft with mica insulation, and the contact fingers, with renewable tips, are of specially heavy and mechanical design. Stamped resistance grids stiffened by a central corrugation are used, and are practically unbreakable, while they are lighter and cool more quickly than cast-iron grids.

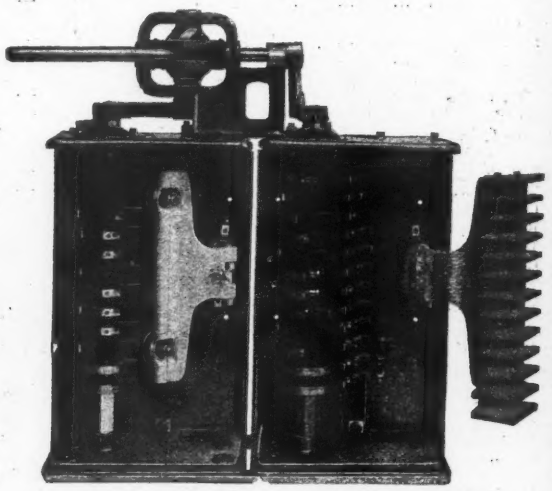


FIG. 2.—DOUBLE CONTROLLER WITH UNIVERSAL GEAR.

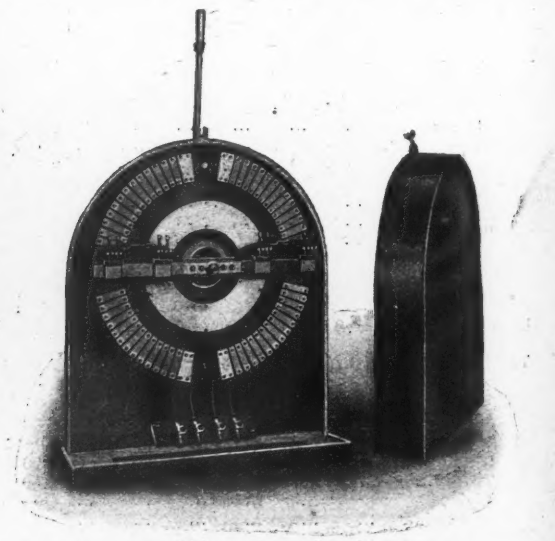


FIG. 3.—HEAVY-SERVICE CONTROLLER.

A "heavy service" controller for steel works, &c., is shown in fig. 3; this type is made for reversing and controlling series, shunt or compound-wound motors on very heavy duty up to 400 H.P. A large number of contact steps is provided in each direction, and the finger-arm is of very massive construction. The contacts are covered by a dust-proof cover. This type of controller possesses marked advantages for continuous service, as the parts are so easily got at that renewals can be effected during ordinary working

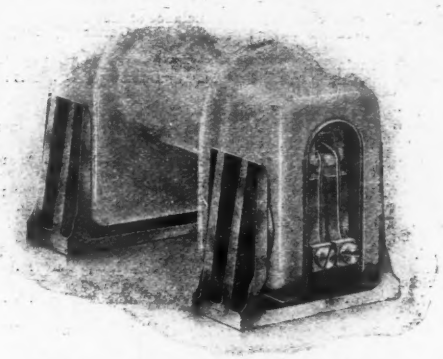


FIG. 4.—WEST'S SELF-ALIGNING FUSE.

intervals; a complete finger-arm with eight fingers can be replaced in three minutes. Besides these, various other types are made, including liquid controllers. West's self-aligning fuse, which we illustrate in fig. 4, offers a number of advantages; the handle contacts are free, being held in place by springs which make them adjust themselves to the jaws; the latter are solid castings, milled at an angle, so that vibration tends to keep the handle in place; free circulation of air is provided between an inner asbestos tube and the handle, to keep the latter cool, and the hot air rising from the fuse does not pass near the contacts.

Signalling Lamp.

A signalling lamp designed and made at sea by MR. J. V. FOWLER, chief engineer of the ss. *Sirocco*, is shown in the illustration given herewith. It was devised in order to get over the difficulty of the slow cooling of the filament of a carbon lamp, which renders signalling by switching on and off unsatisfactory. It will be seen that the upper part of the lamp—a 32-C.P. carbon-filament lamp—is surrounded by a metal cylinder carried by two brass pillars; a similar cylinder or shutter slides on the lower parts of the pillars, and is pushed upwards by a strong spring in the base. A wire

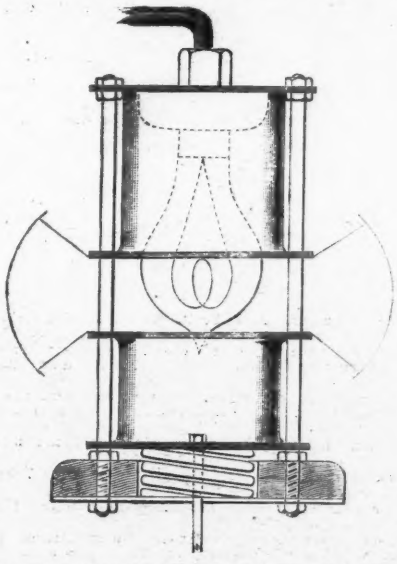


FIG. 5.—SIGNALLING LAMP, WITH SHUTTER LOWERED.

attached to the shutter is led away to a mechanical tapper, with which it can be actuated for signalling purposes. There is no glass about the lamp, and the light is emitted in all directions. We understand that this simple device fills its purpose well; the lamp is burning all the time, and therefore is at full brilliancy directly it is exposed. A thin rubber ring cemented to the flange of the shutter renders it quite noiseless in action.

Adams Igranic Lifting Magnets.

THE ADAMS MANUFACTURING CO., LTD., of 106, New Bond Street, W., have commenced the manufacture of lifting magnets for handling pig-iron, iron and steel plates, rails, girders, castings, &c. These magnets are made in four sizes, ranging from 36 to 62 in. diameter. The convenience of lifting magnets, and the economy of time and labour resulting from their use, place them amongst the most valuable aids in engineering shops and yards, and it is surprising that they are not more frequently employed.

Regulating Transformers.

The FOSTER ENGINEERING CO., LTD., of Morden Road, Wimbledon, S.W., have just completed a large order for a special type of regulating transformer for use in the manufacture of metal-filament lamps—the same transformer as is used in the firm's own lamp works. This regulator is double-wound, and gives any voltage up to 300 volts in steps of 5 volts, the output per transformer being 5 amperes at any voltage. The cooling is effected by air in the smaller sizes, and by oil in the case of larger outputs.

The company have for some time specialised in the manufacture of transformers of all kinds, single and polyphase, and are now making a special feature of large power transformers.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

NEW SWEDISH TARIFF: ALTERATIONS.

INFORMATION has recently appeared in the ELECTRICAL REVIEW regarding the proposed new Swedish tariff, which is to come into force on December 1st of this year, and in the issue of May 12th it was stated that revisions might be made as a result of the conclusion of treaties with other countries. A treaty has now been concluded between Sweden and Germany, which considerably modifies the rates of duty as originally fixed. These new reduced rates will also be applicable to goods imported from the United Kingdom, as a result of most-favoured-nation arrangements. The following statement shows the new rates in cases where changes have been made from the rates already given in the ELECTRICAL REVIEW of May 12th, 19th and 26th:—

£ 1 kroner = 1s. 1½d. 1 kg. = 2·204 lb.

	Kroner per kg.
Machine and transmission belts, &c., of leather ...	·60
Other manufactures	·80
Packing and insulating materials of soft india-rubber in combination with textile materials, asbestos, &c.	·25
Articles of hard india-rubber not specially mentioned	1·20
Lamp shades of glass	·90
	Per 100 kg.
Wire of iron, cold rolled or drawn (other than polished, or so-called, silver, steel, and piano wire):	
The greatest dimension of the cross-section being 1·5 mm. or more	4·50
The greatest dimension of the cross-section being less than ·5 mm.	9
N.B.—Wire coated with other metals pays a surtax of 15 per cent. on the above rates.	
Axles, straight, not worked for railway or tramway material	5
Axles, straight, worked for railway or tramway material	6
Wheels, loose, not worked, also tires	5
Sets of wheels, springs, buffers, &c.	6
	Per kg.
Copper wire, rolled or drawn:	
Of round, square, rectangular or hexagonal section: also so-called trolley wire (contact wire):	
Of other section	·18
Furnished with sheath of lead or other metal, with or without armouring, even if in combination with other materials; also electric cables or lines furnished with similar sheaths, with or without armouring:	
Of a maximum diameter of 15 millimetres ...	·10
Of greater diameter	·09
NOTE.—Wooden drums are not included in the dutiable weight.	
Coated with india-rubber, gutta-percha, or other insulating substances not specially mentioned, whether alone or in combination with textile materials, paper or asbestos; also electric cables, lines and cord insulated in this way:	
Armoured with at least seven iron wires, each more than 1·5 mm. thick	·15
Other kinds, the wire being more than 2 mm. thick	·25
NOTE.—If cables, lines or cords contain wire of different sizes, duty is levied at the rate applicable to the wire of the least thickness.	

	Per 100 kg.
Boilers, riveted	6
„ pressed or welded	7·50
Condensers imported with the machines to which they belong shall be dutiable at the rate applicable to such machines. This provision shall only apply to steam engines and steam turbines, ice and refrigerating machines, locomobiles and steam pumps, when the machines with the condensers belonging thereto have essential parts in common.	
Gas, photogen, benzine and other combustion and explosion motors, also hot-air motors:	
Weighing more than 500 kg. and not more than 1,500 kg.	20
Weighing more than 1,500 kg. and not more than 5,000 kg.	12
Weighing more than 5,000 kg. but not more than 25,000 kg.	9
Weighing more than 25,000 kg.	6
Steam and other cylinders, worked, imported separately, for machines of all kinds:	
Weighing each not more than 50 kg. net	50
Weighing each more than 50 kg. but not more than 200 kg. net	30
Pistons worked, imported separately, with or without piston rods, for machines of all kinds, weighing each not more than 25 kg. net	50
Electrical machines, such as generators, motors and converters, also transformers and damping rollers:	
Weighing not more than 50 kg. net each	55
Weighing more than 50 kg. and not more than 100 kg.	38
„ „ 100 „ „ 500 „	28
„ „ 500 „ „ 3,000 „	22
„ „ 3,000 kg	15
Stators, rotors, current collectors, magnet poles, brush holders and coils when imported separately	Dutiable as electric machines, with an addition of 50 %.
NOTE.—No surcharge will be levied in case of renewals for worn-out or otherwise useless parts.	
Accumulators:	
Unmounted cells, except galvanic, wooden frames and platforms belonging to accumulators, and imported at the same time, accumulator plates with wooden disks and parts belonging to them, rectangular glass jars of a capacity of at least 3·5 cb. decimetres for accumulators, and wooden boxes lined with lead, also galvanic elements ...	6
NOTE.—Glass tubes for accumulators imported at the same time are dutiable under this heading.	
	Per kg.
Incandescent lamps:	
With filaments of metal wire	4·00
NOTE.—Deduction in weight is allowed for boxes, paper and similar receptacles.	
Carbon, not specially mentioned, manufactured for electrical purposes:	
Of less weight than 3 kg. net:	
Carbon brushes, even if in combination with other material	2·50
Safety appliances, mounted on porcelain insulators (not plates); reduction, regulating and combination resistances; controllers and other electric regulators; also boards for electric apparatus and instruments, fitted, and cell switches	0·35
Current regulators (current interrupters and reversers):	
Oil transformers to be worked by hand	0·30
Knife switches mounted on slate slabs	0·50
Incandescent lamp frames, with or without current regulator, are to be treated as box transformers.	
Steel-armoured conduits for insulating...	0·10

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

12,784. "Means for attaching lamp shades or the like to electric lamp-holders." J. G. BERRY. May 29th.

12,788. "Electric telegraph insulators and the like." J. BALL and J. LINGARD. May 29th.

12,816. "Magnetic compasses and the like." W. T. ST. AUBIN. May 29th.

12,828. "Electrical reversing apparatus for remote control." SMITH, MAJOR & STEVENS, LTD., C. G. MAJOR and G. KENNARD. May 29th.

12,860. "Fittings for electrical conduits." BARTON & SONS, LTD., and A. J. HARPER. May 29th.

12,898. "Signalling devices for telephone systems." A. J. DUNTON. May 29th. (Complete.)

12,907. "Telephonic relays." C. H. PRITCHARD. May 29th.

12,918. "Systems of electric distribution." BRITISH THOMSON-HOUSTON Co., LTD., and F. P. WHITAKER. May 29th.

12,919. "Electric switches." BRITISH THOMSON-HOUSTON Co., LTD., and J. M. WALLACE. May 29th.

12,921. "Allgemeine Elektricitäts-Ges. systems of electric motor control." (Convention date, May 27th, 1910, Germany.) May 29th. (Complete.)

2,923. "Electrical heating apparatus." W. P. PERRY. May 30th.

12,941. "Electric solenoid railway carriage and safe lock." J. T. RUSSELL and C. S. SOUNDERS. May 30th.

12,954. "Electric resistances for electric heating and cooking apparatus." F. A. WILKINSON. May 30th.

12,955. "Electric conductors for vacuum apparatus, and method and means of sealing same into quartz and the like." BRUSH ELECTRICAL ENGINEERING Co., LTD., A. E. SALISBURY and T. MILLS. May 30th.

12,976. "Electric condensers." AKTIESELSKABET HOVLANDS RADIO-TELEGRAF. (Convention date, June 1st, 1910, Norway.) May 30th. (Complete.)

12,978. "Means for varying the inductance of electric circuits." G. SCHIEFERSTEIN. (Convention date, May 30th, 1910, Germany.) May 30th. (Complete.)

12,984. "Terminals for ignition plugs, magnetos, and other electrical connections." W. H. MOORE and A. SHARDLOW & Co., LTD. May 30th. (Complete.)

12,994. "Time switches." J. D. B. FULTON. May 30th.

13,014. "Apparatus for discharging excess of electrical pressure." W. A. A. BURGESS and W. L. SHAND. May 30th.

13,020. "Installations for wireless telegraphy." G. MARCONI and MARCONI'S WIRELESS TELEGRAPH Co., LTD. May 30th.

13,021. "Electric conductors more especially suitable for use as incandescing bodies for electric lamps, furnaces, and the like." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) May 30th. (Complete.)

13,026. "Supporting devices for electric illuminating bodies." J. FRIEDREICH. (Convention date, May 30th, 1910, Austria.) May 30th. (Complete.)

13,037. "Non-corrosive terminal for accumulators." A. E. HARRIS and G. R. DEE. May 31st.

13,099. "Generation of alternating electric current." E. ROSENBERG. May 31st.

13,100. "Devices for the recording and reproduction of telephone communications." G. SCHNEIDER. May 31st.

13,102. "Systems for electrically controlling the operation of time-indicating devices." L. J. ARON. May 31st.

13,103. "Automatic electric switches." R. F. VENNER and R. C. GRIESBACH. May 31st. (Complete.)

13,124. "Arc lamp electrodes." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) May 31st.

13,142. "Instrument for trimming magneto contacts." H. G. LONGFORD and W. G. ASTON. June 1st.

13,177. "Electric metallurgical furnaces." V. STOBIE and S. DAVENPORT. June 1st.

13,203. "Magnetic compasses." E. H. CLIFT. June 1st.

13,213. "Electric wiring of buildings." L. MILNE. June 1st.

13,246. "Pole shoes of magneto-electric machines for ignition purposes in connection with internal-combustion engines." ELECTRIC AND ORDNANCE ACCESSORIES Co., LTD., J. R. GARNER and N. COLLINS. June 2nd.

13,266. "Electrical accumulators for ignition, traction, lighting and other purposes." J. BAYLEY, jun., and H. T. WOOD. June 2nd.

13,282. "Apparatus for effecting the automatic forming of metal filaments for electric incandescent lamps." E. C. R. MARKS. (Gans & Goldschmidt Elektrizitäts Ges. m.b.H. and Martin Kaul, Germany.) June 2nd.

13,285. "Electric lighting of staircases." T. HUMMEL. June 2nd. (Complete.)

13,299. "Batteries." W. E. LAKE. (United States Light and Heating Co., United States.) June 2nd. (Complete.)

13,315. "Electric current limiting apparatus." COMPAGNIE POUR LA FABRICATION DES COMPTEURS ET MATERIAL D'USINES A GAZ. (Convention date, November 11th, 1910, France.) June 2nd. (Complete.)

13,338. "Systems for electrically operating time-indicating devices." H. CREESE and L. J. ARON. June 2nd.

13,341. "Switch for electric illuminating devices." C. GRAEBE and C. LEHRBACH. June 2nd. (Complete.)

13,362. "Electrical machines." P. N. NISBET. June 3rd.

13,403. "Electric resistance furnaces." T. H. BRADBURY. June 3rd.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

TELEPHONE APPARATUS. A. J. Boult. (International Telechronometer Co. 11,048. May 4th.

STARTING DEVICES FOR ELECTRIC MOTORS, PARTICULARLY ADAPTED FOR USE WITH MULTIPHASE MOTORS. Adams Mfg. Co. (Cutler-Hammer Mfg. Co.) 11,186. May 5th.

ELECTRIC MOTOR PLANT HAVING MEANS FOR EQUALISING THE LOAD ON TH SOURCE OF ELECTRIC ENERGY. Adams Mfg. Co. (Cutler-Hammer Mfg. Co.) 11,459. May 9th.

SAFETY DEVICE FOR LOCKING INCANDESCENT ELECTRIC LAMPS IN THEIR HOLDERS. G. H. Ide. 11,747. May 12th.

AUTOMATIC TELEPHONE SYSTEMS. American Automatic Telephone Co. and C. P. Goodrum. 12,614. May 24th.

ARC LIGHT ELECTRODES. British Thomson-Houston Co. (General Electric Co.) 13,518. June 3rd.

MEANS FOR ESTABLISHING ELECTRICAL COMMUNICATION BETWEEN TWO APPROACHING RAILWAY ENGINES, SAME BEING ALSO APPLICABLE FOR AUTOMATICALLY OPERATING BRAKE MECHANISM. J. L. Bryan. 13,583. June 4th.

ELECTRIC CONDENSERS AND THE LIKE. Siemens Bros. Dynamo Works. (Siemens-Schuckertwerke Ges.) 14,092. June 10th.

ELECTRIC DRILLS. A. Stewart and Westminster Tool and Electric Co. 14,505. June 15th.

DEVICES FOR SECURING WIRES OR CONDUCTORS IN PLACE. British Thomson-Houston Co. (Allgemeine Elektricitäts Ges.) 18,867. August 10th.

1911.

APPARATUS FOR ELECTROPLATING. M. Reid. 580. January 7th.

ELECTRICAL SWITCHES. A. W. Penrose. 1,037. January 14th.

TIME-SWITCHES FOR CONTROLLING ELECTRIC CIRCUITS AND FOR TURNING ON AND OFF GASLIGHTS. J. A. Mehne. 2,259. January 28th. (Patent of Addition to No. 14,052 of 1909.)

ELECTRIC SWITCHES. Sun Electrical Co., J. J. Rawlings and G. Sweetser. 3,705. February 14th.

RADIO-TELEGRAPHIC PLANT. E. Girardeau. 3,947. February 16th. (December 1st, 1910.)